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The Automobile

BUOYANT, sparkling with reserve energy, sound to the core, and most promising product of the arts, the automobile makes its bow for 1911. The story of the growth of this great enterprise is told in statistics to the man who professes no time to devote to romance; it is recapitulated in the tabulations of the modes of the respective makers, some of whom are displaying their wares at the Grand Central Palace, under the banner of the American Motor Car Manufacturers' Exhibit Association, having opened the doors on December 31,

with the closing date fixed for January 7. The foreign makers of automobiles, fighting to maintain a footing, opened the Salon, at the Hotel Astor, on January 2, with the closing date fixed as January 7. Madison Square Garden will be the scene of the Eleventh Annual Show of the Association of Licensed Automobile Manufacturers; the grand opening will take place on January 7, and, contrary to custom, the show will be held in two sections—the first, comprising the "passenger automobile" display, which will end on January 14, to be followed by the "freight automobile" display, the latter to run for just one week. The magnitude of the "Garden" enterprise is not to be outlined in words; to appreciate just what this great enterprise means, it will be necessary to have patience, visit the show, mingle with the makers, view their wares, talk with the experts who will be gathered there for the very purpose of entertaining their friends and explaining to them how the automobile has progressed and prospered; why the upward trend has been steady and reliable in the face of much opposition on the part of those who are blinded by personal gain to so great an extent that merit might run its legs off ere they would deign to notice it unless it offered to them a chance to glean a mite.

New York City Holds No Exclusive Brief

But if the activities in New York City are on a most extended basis, the fact remains that other cities are making ready to accomplish much. It will be just two days after the closing of the "pleasure automobile" section of the Garden show when the Philadelphia Licensed Dealers will hold their annual show. This event will open doors on January 14 and the show will end on January 28. From indications it would seem that the Philadelphia event of this character this year will be on a most comprehensive scale, two buildings being necessary.

Detroit, the home of a great number of automobile makers, and a ponderous array of accessory manufacturers, will hold its annual show, beginning January 16, and closing January 21. The next event of great moment will be the Tenth National Automobile Show, under the auspices of the National Association of Automobile Manufacturers, which will open at the Coliseum, at Chicago. This display will be the most varied of the year, and if former glory counts, it is not too much to say that it will be as the name implies.

January is to be a busy month in the annals of the automobile; there will be shows of the first magnitude; the patrons of the industry will have an opportunity to study the trend and to learn how the makers everywhere are keeping faith with progress. The end of January will scarcely conclude the exhibition phase of the industry. February has a large list; March will have a share, and the last show now listed will be held in Montreal, Canada, in April.

What Is the Outlook for the Man Who Buys?

Ten years' history of the automobile industry is being recounted in the pages of THE AUTOMOBILE. If looking backward is worth while, why not try this plan: read the ten years' history; ascertain by comparison whether or not progress has been made; weigh each year's effort in a balance, using the next succeeding year as the counterweight; observe whether or not the men who are now at the wheel are not utilizing the very tools that foresight fashioned out of rude materials, and ere the task is completed form an opinion of the value of the raw material?

Diamonds are wrought from Nature-formed materials; to a native of the Sahara they would look like cobblestones do to a Brooklyn urchin, and yet, under the manipulation of the craftsman, they shine and glisten, absorbing light and casting it off again to the delight of the fair wearer, who, knowing that Nature made them, feels content. Is it not also true that Nature formed the automobile; the roadway part, of course, and in an indirect way the other half? Nature's laws are being transgressed when a burden is borne in any but the way that will conserve energy; it is wasteful of energy when the load is so great that the bearer is wearied; it is the automobile to which man must look for the relief of the load that bears down.

More of Nature's laws are being conformed to when the automobile is used as the instrument of transportation than could have been claimed for any of its predecessors. To whatever extent natural laws are satisfied in a machine of any kind it would be possible to say for it that perfection has taken up its abode and it will serve its intended purpose with greater fidelity. The greatest safeguard in the world from the purchaser's point of view will be present in any equipment that he elects to acquire which violates the least number of natural laws. When the means for transportation consisted of fork branches of fallen trees, and the Medes, Persians, Assyrians and Egyptians resorted to this crude type of vehicle, however inefficient it may be regarded in the light of present knowledge, it was as a stroke of genius 6000 years B.C., and it meant to the bearers of that time that instead of lifting a ton of weight bodily and bearing it along, it could be put upon the "tree-car" and a draw-bar pull of something like 200 pounds would suffice in the transportation of 2,000 pounds. This was the most efficient vehicle that "unmechanical" man of the earliest time was capable of producing, and when he went into partnership with Nature in the devising of this plan, he showed his confidence in natural law, and the price he had to pay for his tree-car was in keeping with the service that he was able to obtain from its use.

It took a thousand years for man to so compound his thoughts that he could dispense with the use of the fork-branches of trees, and even then the principle of the roller was too complicated to find lodgment in the attenuated gray matter of this relatively primitive being; but in something like 5000 B.C. it occurred to the automobile engineers of that time that a forked tree was a brutally unstable platform, and some one of them—being at the head of the class perhaps in the school of the day—thought out the idea of using runners, in other words a sled. It is not believed that the runner idea reduced the draw-bar pull per ton very much, but it proved to be a more stable proposition, all things considered, and it

has survived through the ages down to the present time, finding fitting use in the Winter time in bob-sled formation and otherwise, and it is not unusual for contractors on occasions to traverse back 7000 years in taking advantage of what is now known as the "stone-boat."

Ten centuries more and it dawned upon those progressive engineers there that a roller slays friction, and it was a fine display of the reasoning power of inventive genius when trees were cut down and sawed into suitable lengths for use as rollers, much as men use them in moving houses at the present time. This roller idea seems to have been in use around 4000 B.C. Some clever chap, an Edison in his time no doubt, bored a hole in a couple of these rollers quite near the center, perhaps, and cut down a tree of small diameter, but relatively round, and stuck a disc on each end of the same, forming an axle-set, upon which he tied a platform for the accommodation of weights to be transported, and this epoch-making invention was placed at the disposal of discriminating buyers, perhaps prior to 3000 B.C.

History seems to have ample material to bear out the contention that dissatisfaction reigned in all ages. The coming of the crude cart marked the dawn of animal transportation, but it is feared that the first draft animals were unwilling slaves, less strong than other human beings in the fighting sense, but muscular enough to furnish the necessary draw-bar pull for a crude cart. There is no authentic record which will suffice to prove that any one of these slaves had brains enough to invent anything, but we venture the assertion that quite a number of them were envious of the ox whose sleek sides glistened in the sunlight in nearby green pastures as the slaves who formed a part of the cart innovation tugged the load. It would be real clever were some one of these slaves to swap places with an ox, but it probably remained for some thinking automobile engineer to arrive at the conclusion that an ox has to be fed whether he is worked or not, whereas a slave would have to feed himself if he were turned loose. History seems to prove that oxen were drafted into this service not far from 3000 B.C., and that the peculiar merit of this considerable improvement over slaves in animal transportation service is most appealing, and the men of that day who busied themselves with thoughts along economic lines must have foreseen that the ox would pay for his feed by pulling a cart, that he could go to slaughter when age took the springs out of his muscles, and that the slave could be dispensed with as being an unnecessary evil.

Egyptian plaustrum carts came into vogue between 4000 and 2000 B.C., but they differed from the other efforts referred to in that they were drawn by horses; but nowhere do we find the name of the inventor who saw in the horse the means for a more efficacious draw-bar pull than that afforded by the ox, and in all probability there was a controversy of no mean proportion between contending engineers of this remote period, the ground for debate being based upon the characteristics of the respective animals. Those in favor of the ox must have pointed out that he is slow but sure. There is no doubt of the ability of the ox to exert a greater draw-bar pull than that which can be expected from the more nimble horse. The more progressive engineers, they who advocated the horse instead of the ox, very likely showed their acumen in debate in pointing out that more trips are possible when the horse is used, and while the load would have to be lightened, the aggregate of weight would fall to the horse in greater proportion.

The Big Limousine Had an Early Prototype

The Scythians, between 2000 and 1000 B.C., being nomadic, recognized the ruling characteristics of the big limousine; they put their huts on wheeled platforms and went on long tours to Asia Minor.

Those who have burned midnight oil and agitated "attic salt" will remember in perusing Homer how Juno's carriage with whirling wheels on iron axles glistened in the sunlight due to the high polish which was imparted to the eight brass spokes which joined the felloes with the hubs of the respective wheels. The guardian of Juno must have recognized the preciousness of his burden and the necessity of strength of the equipage, and that he arose to the occasion and planted himself upon the platform which will ever hold the immortals among inventors is proven by his introduction of the iron axle and the built-up wheel. The next notable advance seems to have been around 1000 B.C., when Plinius reports that the chariot on four wheels came from the Phrygians before Rome was founded. Referring to the Roman transportation engineers, it seems that the arcera, which is mentioned in the Twelve Tables, was not unlike an ambulance. Just to indicate that the desire for quick transportation is not a modern institution, and that "joy-riding" is nothing new, it is only necessary to recount how Cæsar went from Rome to Gaul in one week, using a relay of coaches. What a boon it would have been to Cæsar could he have taken advantage of the energy stored in a 20-gallon gasoline tank riveted to the tail-end of his Roman vehicle!

There are no records of weaklings among the Romans, so it must be true that the Roman ladies had complexions. Cæsar issued an edict forbidding too much luxury in the modes of transportation as they were taken advantage of by the Roman matrons, but this did not prevent the use of hoods for chariots, although the musty pages of the doings of men would seem to indicate that tops were invented by the Etruscans.

The dawn of the Christian era witnessed the coming of the four-wheeled carrucca, with seats for two only, and this was undoubtedly the gala vehicle of the time. The ancestor of the latter-day chauffeur seems to have been quite the thing in connection with this type of vehicle, and the problem which confronts many of the automobile owners of the present day was the problem then. There are no doubt a goodly sprinkling of those who affect automobiles who lament the fact that the chauffeur has ears and that they number a nose among their five senses. In the Roman carrucca the driver's seat was in front, and at a considerably lower level than the seat which was provided for the proud owner. Historians are good enough to affirm that this particular con-

veyance represents the origin of the latter day "carriage." That the Romans introduced art in carriage building is a bit of history that should not go unnoticed, and among the types of vehicles that were current the pilenum was exclusively placed at the disposal of the matrons of the time; it seems to have been more or less a phaeton, since it was provided with a canopy and four posts, and the artist worked out his purpose in gilt and bronze, varying the motif by taking advantage of the decorative effect of ivory interlaced in rare woods.

Experience Indicated the Need for More Power

It was the Romans between 300 and 400 A.D. who seem to have realized that a 2-horsepower wagon had many shortcomings, and the carpentum, which looked much like a carved baker's delivery wagon, came in vogue. It wrought a change in the method of hitching up the horses, introducing the tandem idea. In this tandem scheme the rigs as driven by ladies had two horses, but when men drove two spans of horses were used. It was probably found that more power which came from the addition of horses in tandem could only be utilized comfortably and commercially in conjunction with improved vehicles, and the Roman cisium was invented for the occasion, and it is this type of vehicle which took final form as a cabriolet hung by leather straps.

The Middle Ages did not seem to have a place in the forms of civilization extant for the engineer. The improvements as they were introduced by the Romans languished. The cabriolet went out of use and the leather strap method of suspension was forgotten. For a couple of centuries the only vehicle in service was a two-wheeled affair, as previously used by the Romans for the transportation of the images of the Roman gods. They must have thought quite favorably of these gods because the two-wheeled carts were built with a top in imitation of the temple, with columns, pilaster, and what the canny Scot would call "ginger-bread." This poor estate of the transportation engineer probably reached the low ebb of the receding tide in 1294 A.D., when King Philip of France made a sumptuary law prohibiting plain citizens from using carriages. As ridiculous as the King's law would appear to be, as viewed by a plain citizen of to-day, it was no more so than the ridiculous rigs which kings affected in that time, and mention is made in history of the caretta which Pope Gregory possessed. It was drawn by two horses tandem, and one modern writer said: "It looked like a prairie schooner." By the time Richard II of England preempted the throne the questions of transportation were again awakening, and this worthy potentate was extremely fond of inviting his friends for a ride in a royal whirlicote.

By the time Queen Mary went to coronation in 1554 things had prospered until it may be said that the unfortunate Queen Mary at least underwent the enjoyment of a coronation pageant, occupying the seat of honor in a cabriolet. In 1581 the English sedan chair was put on wheels, and in this way the transportation engineer of that time placed himself high in the estimation of invalids; they used the chair. This century saw the introduction of the leather suspender again, the innovation coming from Hungary, thus indicating that the idea of the quick and efficacious transportation of persons and chattels is a progressive one, and so it would seem that when a good plan is abandoned by one set of people it is taken up and perpetuated by another, and evidently the discarding of the leather suspender, or brace, was re-introduced in western Europe by the Hungarians under auspicious circumstances when Ladislaus of Hungary sent such a carriage as a present to Charles VII of France.

Improvements in the art of fabricating glass added to the range of the carriage-maker, and in 1650 glass windows were introduced in French carriages. It was in 1670 that steel springs were produced, simultaneously in France and England. By this time Charles II of England joined the ranks of transportation engineers, and among his activities mention is made of the fact that he formed the first coach-makers' company in 1677. In an old pamphlet, which was published in France after this date, the publicity agent, who was responsible for the brag advertising it contained, waxed enthusiastic in favor of carriages as against sedan chairs. Cabriolets came into vogue in 1672 as the product of France, and in Italy postchaises were the order of the day, but they had the same disorder which fell to the lot of the automobile of a few years ago; they were patterned after sedan chairs just as the early automobile was patterned after horse-drawn vehicles.

The coupé came from the Continent, and was fashionable between 1670 and 1700; Berlin was its favorite haunt. In this rig the springs reached from the front to the rear wheels, and the high driver's perch came as a modification, combining the features of two or three rigs of the time, the most notable example being the chariot à l'Anglaise. Concomitant with these activities came the landau, which seems to be the cradle, so to say, of the modern coupé; but the landau of 1700 could be opened.

The eighteenth century witnessed the introduction of the high-perch phaeton, which was the particular device of the young bloods, of which George III was no mean competitor. The briska was brought out at about this time, and it is worthy of mention as being the first type of vehicle on which C springs were used, this type of vehicle having become particularly conspicuous in the early Victorian era; it is not unusual to see these springs on automobiles at the present time.

The Modern Automobile Seed Planted in 1804

Napoleon Bonaparte, after his precipitate flight from Moscow to the French capital, had a penchant for the comforts of traveling, and as the result of his experience, Napoleon's campaign carriage was not unlike a modern limousine of the most extreme order, including a bedroom, library, butler's pantry, and every modern convenience, and for motive power six horses served in the absence of an internal combustion motor, which Napoleon persisted in believing was an idle dream.

In a hundred years time has proven that the conqueror of nations compared favorably in point of knowledge of

transportation with a chauffeur who would fail to pass an examination under our present State law. In 1804 Obadiah Elliot patented elliptical springs, and this particular feature represents one of the inventions of the early type of, let us say, automobile engineer, which time has not erased. The Elliot type of spring, coupled with the advances of 30 years, resulted in the hansom type of vehicle, which was brought out by the inventors in 1834 in England. The hansom cab was a well-known and much appreciated type of vehicle for metropolitan work for many years, but it finally succumbed to the taxicab.

Tracing the Ramifications of the Automobile

Leaving it to the historical story, as it appears in THE AUTOMOBILE this week, to trace the trend for a decade, calling attention to the reproduction of a dozen of the older models for purposes of comparison, among which is the sketch of the first automobile produced by George B. Selden, dating back to 1877, and passing over the earlier activities of the automobile makers of France and Germany, this part of the story opens with an event which took place in the Spring of 1895, known as the *Times-Herald* run, which was for a duration of 3 days, starting on November 1 of that year. This was really the first public display of the "metal" of which automobiles were then made, and it was to the credit of H. H. Kohlsaat, then proprietor of the *Times-Herald,* that this introduction publicly of the automobile in some force was brought about.

One of the most potent grounds for believing that the automobile possessed unusual merit was based upon the contention that men like Pennington would be "working" some other field were there any question of that peculiar merit which attracts the well-balanced notice of the man who will risk his funds if the dividend looks as big as the risk. The *Times-Herald* run, while it brought the "Penningtons," was also noteworthy in that it permitted the pioneers of the industry to show how really bad their automobiles were; and yet shining through the mist of undesirables was the nucleus of that peculiar worth which survives the vicissitudes of time, coming out triumphant in the end.

As Charles E. Duryea put it in discussing the merits of the first American race, "there were few starters and fewer finishers." Leaving it to history for the particulars of this and other events, it remains to point out the things that have started the progress of the industry and to observe how the trend is being fashioned, interjecting harmony of relation of the components where chaos reigned. Of all the retarding influences that stalked as specters before the eyes of the men who are responsible for automobile progress, it is scarcely to be supposed that anything is so prominent as the type of men who rank neither as builders nor users, but whose names are found in the publicity of the day, coupled with that peculiar order of literature (?) which tells how the men who never do anything would do it. Free advice is responsible for more dissatisfied owners of automobiles than any other single condition.

The makers of cars and the men whom they rely upon to evolve results are scarcely equipped, owing to lack of time, to cope with the fallacies which ever emanate from irresponsible sources, and the users of automobiles in addition to getting service out of the cars they put their money into, being fertile of brain, were enabled, by virtue of their experience, to make suggestions that frequently served a fitting end, and that sometimes, like a sore thumb, struck against everything which they came near, simply because they were out of place.

The first few years of the modern automobile were disconcerting in many respects, due to the influence of the rigs that were pulled by horses, and to the fact that the patrons of the industry, while they knew nothing whatever about the building of automobiles, felt quite satisfied that if they could not have a horse in front they should have something else. These same patrons, not being satisfied that the "something" would be provided by the makers of influence, were much inclined to furnish the necessary impetus, and it is feared that some of them really succeeded in getting what they thought they wanted. The echo of it all sounds too discordant to lend the impression that these patrons were content.

In the course of time the builders of automobiles were able to convince a growing clientèle that it was not necessary for a buyer to advise the makers in the customary mechanical ways, and the principles which underlie business in general taught these makers how to maintain the integrity of their investment, and to disregard suggestions, however good they might prove to be in the long run, in so far as they might upset the plans in process and become inharmonious.

It is a little difficult to get the American user into the state of mind which will permit him to clearly appreciate the fact that an idea, however good it serves in France, for illustration, might be valueless in America, and that a scheme which attracts the notice of the German may be obnoxious for a hundred reasons when it is transplanted, and that the heavy construction of the English car, although it is intended to portray stability, has nothing much to recommend it when the weight must be carried on pneumatic tires over the ups and downs of American roads.

One of the serious problems, and yet it must be solved, comes with the foreign mail; the American users of automobiles read extensively about economy runs in France, they hear wonderful tales of the performance of the long-stroke one-lunger, and they say: "Why don't we do that?" On second thought, why should we do anything like that? We do not have to pay 40 cents a gallon for gasoline, nor do we live in a country where a franc is as big as a dollar. Moreover, our problems are peculiar, and it is more than likely that any attempt to solve them on a basis of French philosophy will be in sharp contrast with that measure of success which we figure upon attaining.

The American designers, while they have had many opportunities to copy the expressions of the automobile art as they come from other lands, have been compelled to take cognizance of experience, and one of the misfortunes of the time is entirely due to the narrowed field of vision of the user as compared with the many opportunities to see from the vantage point of the designer.

The American idea is winning out; where it had ten friends yesterday it has a thousand to-day, and when the to-morrow of the automobile industry comes, its enemies, if it has any, will reside in chateaux in foreign lands, and their enmity will be bitter in proportion as their experience is broad.

If "China for the Chinese" is a good doctrine, the same idea applies, but with greater force, when it is automobilized; American automobiles for the American user is what experience dictates; insurance statistics tell a marvelous story, and the man who has his car insured knows by the magnitude of the premium whether or not it is a good machine for American conditions. There is one other point in relation to the insurance question which cannot be overlooked; when an applicant goes to have his automobile appraised for insurance purposes he will invariably find that the appraiser persists in considering the American road conditions. He also takes into account insurance statistics. It is the insurance man who has the mortality list of automobiles up his official sleeve when he makes the rate, and the man who has to pay will very quickly discover that sentiment is whittled down to probably less than 1 per cent. of all the factors that are taken into account in determining the equity of the insurance rate.

The Present Status of the Automobile Industry

A few years ago, when the Licensed Association of Automobile Manufacturers was instituted for purposes which seemed to the members to be beneficial, their deliberations soon led them to reach the conclusion that the problems involved should be amplified and that the path to the final standardization of the automobile should be blazed. The first move in this direction culminated in the organization of what was then called "The Mechanical Branch." The body politic of this auxiliary body was made up of the chief engineers of the various allied makers, and they met with great frequency for purposes of discussion, the comparing of notes and the elucidation of the problems involved. The literature of the mechanical branch was ultimately the basis of a system of standards which was finally promulgated under the auspices of the Society of Automobile Engineers, and when the Mechanical Branch became inactive, its records of experiences and standards were placed at the disposal of the Society of Automobile Engineers, forming the nucleus of an effort which has since been extended to the good of the industry.

The best guarantee that purchasers can possibly have of the stability of the American-made automobile is present in the concerted effort of the American automobile engineers, and the fact that they are members of a common body, and that they meet at frequent intervals for the purpose of comparing notes, is assurance enough to the buyer that if the American-made type of automobile differs in important particulars from those which come from afar, the reasons for the differences, whatever they may be, are paramount.

As an illustration of the inappropriateness of a transplanted idea, it is only necessary to recount an incident of four or five years ago. It was then that chrome nickel steel became the rage, and quite a number of the builders of cars abroad re-designed the components, as crankshafts, etc., of their products, taking into account the prodigious physical properties of the relatively new material available, and they argued that, as the materials are so much stronger, the quantity required in any given case will be so much the less. It was a grand idea, but it proved to be an academic fallacy. In the first place the modulus of elasticity of these relatively stout materials was no better than the same quality as it will be found in ordinary carbon steel. Advanced American designers took note of this unfortunate fact, and instead of using a reduced weight of the alloyed products, they either continued to use carbon steel, or they reproduced the parts in alloy steel without reducing sections. What was the result? A few months of experience with crankshafts in reduced section of chrome nickel steel showed that they were being broken in service as fast as they were made, whereas the American cars, with their crankshafts maintained of proper size, continued to run to the entire dissatisfaction of those who put their money on the other enterprise.

There is but one reason for discussing in detail matters such as this. It has for its foundation the fact that the result of the deliberations of a body like the Society of Automobile Engineers and its predecessor, the "Mechanical Branch," are scarcely to be set aside by the private opinion of some individual, even though he may have skill, or the whisperings of the wind as it floats across the Western ocean. Those who have in mind the purchase of a car, if they wish to use it in a foreign land, will not be unwise in going to that land to make the purchase; it is well within the range of possibilities that the engineers in other countries know how to build cars so well and faithfully to the requirement as dictated by their road conditions that there will be little left to be desired, and small chance of a foreign-made product excelling.

Among the most noteworthy activities which will redound to the permanent good of the automobile situation, and which will be in the foundation of the 1911 cars, will be mentioned the classification of materials as reported in the transactions of the Society of Automobile Engineers for 1910, in which there are specifications of the various grades of steel ranging from mild steel (low in carbon and unalloyed) up through the entire carbon series, covering spring steel, crankshaft fabrics and specialties, passing on to nickel steel, chrome nickel steel, chrome vanadium steel, silicon steel, alloys for frames; and in the heat treatment of these products specific information is afforded, the character of which was never before placed at the disposal of men in the arts.

It should be well appreciated that the better the grade of material the more skill must be displayed in its manipulation, and the easier it will deteriorate in the hands of the unappreciative. Taking this thought as a basis for further discussion, the conclusion may be reached without jumping the bounds of logic that the automobiles this year must be better than they could have been before,

because a body of skilled engineers have agreed upon the methods of manipulation of the materials; and this is the best assurance of the longevity of the cars that can be devised.

Besides fixing upon steel standards and their method of treatment, the work was extended to include the various bronzes, white metals, aluminum and other like parts, and the shapes of chassis frames were standardized so that a given quantity of specified metal, when heat-treated according to a formula contrived, will afford a stable platform on which to rest the machinery of which an automobile is composed, and do the other things necessary (and there are quite a few) before the automobilist will consent to append his name to a fitting testimonial.

Quite a number of the undertakings of the standardizing bodies among the engineers who are responsible for the perfection attained are too far below the surface to be appreciated by men who merely ride in cars; they would not understand what it means to limit the number of sizes of bar-stock, plates, or what-not, that have to be carried in stock in order to supply the demand. That the cost of good automobiles has been reduced to a very noticeable extent is a point that riders in automobiles do take notice of, and they may as well be told that this reduction in cost was in the face of increasing quality, and that it would have been impossible of accomplishment were it not for economies which were effected in many cases.

By reducing the number of sizes of the stock used, the vendors thereof were enabled to serve their clièntele at a lowered cost, and the manufacturers of automobiles were enabled to order materials with a short interval of time between the placing of the order and the use of the material in the shop. It stands to reason that if all the intervals of time for the respective operations in the building of cars are cut down, the cost of doing the work will be reduced in proportion, and it is a fortunate circumstance that these costs have to do with what is known as "overhead," which is a division of the cost which never adds to the quality of a car, excepting in so far as it is a necessary evil, so that by its reduction through better processes of manipulation and more intelligent management, the selling price may be favorably influenced without affecting quality.

Among the Associations

THE ASSOCIATION OF LICENSED AUTOMOBILE MANUFACTURERS; NATIONAL ASSOCIATION OF AUTOMOBILE MANUFACTURERS; THE SOCIETY OF AUTOMOBILE ENGINEERS, AND MOTOR AND ACCESSORY MANUFACTURERS

DEVELOPMENT of the automobile to its present stage was not accomplished through guesswork and uncertainty. While it has been unprecedentedly rapid as measured by the standards of other lines of human endeavor, it has been brought about through an orderly course of events.

The transition period from the first cranky and unwieldy motor car to the current models of the automobile may be included in a span of a few years, but into those years the art has packed the sum total of human wisdom, enterprise and methodical progress, gained during the sixty centuries of civilization.

The overwhelming influence of the physical individual was thrown down when gunpowder was first used in battle and it was demonstrated that the smaller, weaker opponents of the mailed knight could unhorse the tyrant of the dark ages through organization and the use of firearms and other crude devices.

The towering influence of personality in commerce has also yielded to the universal tendency toward centralization and organization and it may be said without hesitation that the development of the motor could never have been accomplished with anything like its celerity and certainty if it had been based upon the scattered energies of individuals.

The art is largely the work of organizations of potent individuals who have banded together to reach certain goals, and the following outline articles give in brief form the landmark history of several of the more prominent bodies that have borne their parts in the great struggle.

Association of Licensed Automobile Manufacturers

With a community of interest engendered through possession of license rights under the Selden patents, the Association of Licensed Automobile Manufacturers was formed in 1903. Up to that time the manufacture of motor cars had been largely experimental, although a few excellent examples of mechanical worth had been put out.

The object of the organization was to promote better conditions in manufacturing and marketing automobiles. In following this line it has specialized in the protection of the validity of the Selden patents and their legal enforcement. In working for a more healthful condition of the trade, the association has labored for the perfection of the car rather than for an immense volume of production. Despite the fact that production has increased with dazzling speed by the members of the association, a limit for each company was set under certain conditions and a determined effort was made to have the output represent progressive ideas.

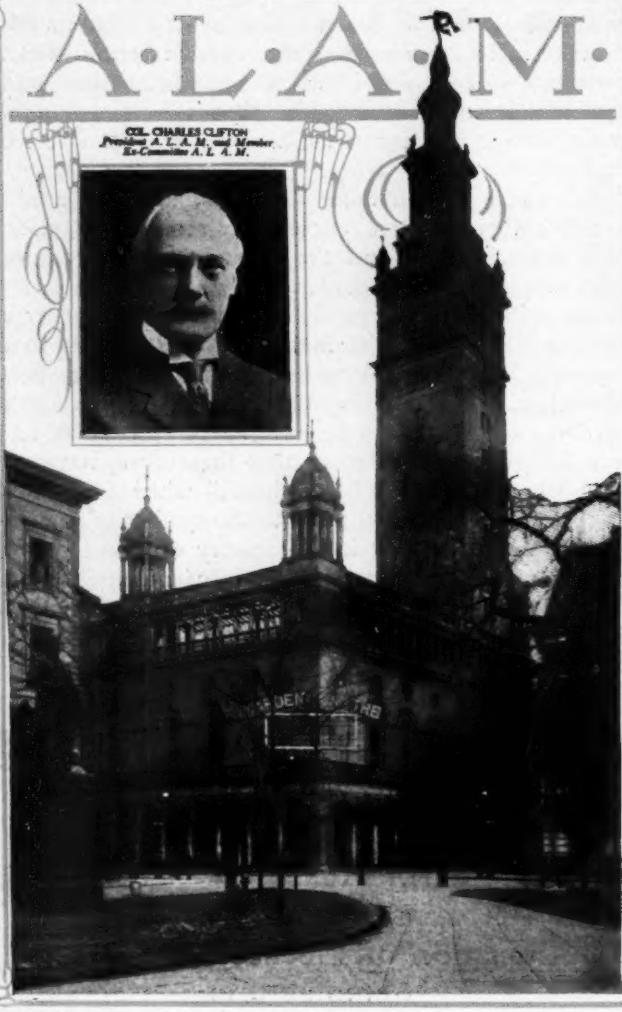
Fred Smith, of the Oldsmobile Company, was chosen president of the association, and George H. Day was selected as general manager. The early period of the life of the organization was devoted to the formation of an efficient, closely-knit body, each of the members contributing a small percentage of the value of his product to furnish thews and sinews for the work of the organization as well as to pay royalties to the holder of the patents.

On this foundation, the great structure of the present has been reared. Its growth was not great until recently, but it was steady from the date of its formation.

The following year, Colonel Charles Clifton was selected to

A·L·A·M·

COL. CHARLES CLIFTON
President A. L. A. M. and Member Ex-Committee A. L. A. M.



MADISON SQUARE GARDEN, SCENE OF A. L. A. M. SHOW

head the association, and from that time until the present he has retained the post of president. In 1907 E. H. Cutler was elected general manager and was succeeded in 1908 by M. J. Budlong and E. P. Chalfant, who served until the present occupant of the administrative office, Alfred Reeves, was chosen.

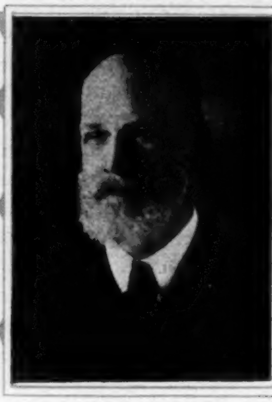
The breadth of the A. L. A. M. to-day is best shown in its membership list and licensees, which contains the names of eighty-seven makers of motor cars.

The product of these companies runs all the way from the smallest runabout to the magnificent, high-powered, six-cylinder car and the giant freight vehicle capable of carrying more than ten tons of merchandise at a speed and cost that seriously threaten the usefulness of the horse.

The A. L. A. M. has taken a commanding position in the show field ever since 1906, when it conducted its first national exhibition at Madison Square Garden. These shows have always proved stimulating to public interest in the automobile and the idea has grown clear away and beyond the original idea of a trade exposition. The growth of the motor can be traced in no clearer and more distinct way than through the shows. Each year has marked progress sufficient to be called revolutionary in any other line, without disturbing the welfare of the association, except to add to its growth.

The association has its part in the legislative field and in various other lines associated with the interests of motordom, but perhaps its greatest work has been its labor and investment in developing the mechanics of the automobile. Early in the history of the association the members decided to establish a

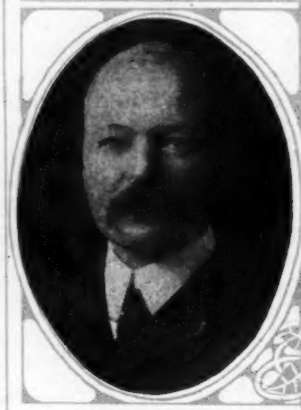
S. T. DAVIS, JR.
Vice-President A. L. A. M. and Member Ex-Committee N. A. A. M.



COL. GEORGE POPE
Treasurer

THOMAS HENDERSON
Member of Ex-Committee A. L. A. M. and N. A. A. M.

HUGH CHALMERS
Member Ex-Committee

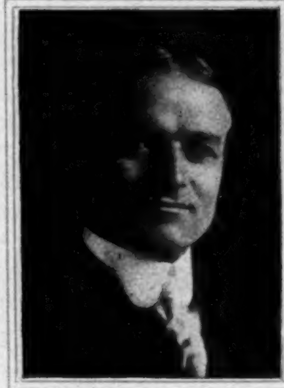


HERBERT LLOYD
Member of the Ex-Committee

ALFRED REEVES
General Manager

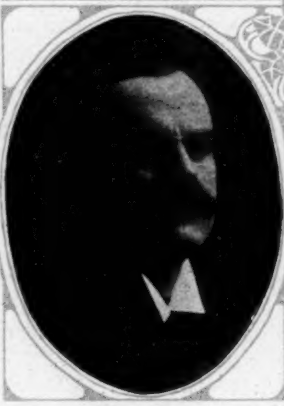
H. A. BONNELL
Assistant General Manager

MERLE L. DOWNS
Secretary Show Committee



C. C. HILDEBRAND
Second Vice-President

WILLIAM E. METZGER
Vice-President



WILLIAM R. INNIS
Treasurer

BENJAMIN BRISCOE
Third Vice-President

WINDSOR T. WHITE
Member of the Ex-Commission

S. D. WALDRON
Member of the Ex-Commission

SAMUEL A. MILES
General Manager

H. O. SMITH
Secretary

N·A·A·M·

L. H. KITTREDGE
President N. A. A. M. and Secretary A. L. A. M.

COLISEUM, CHICAGO, HOME OF NATIONAL SHOW

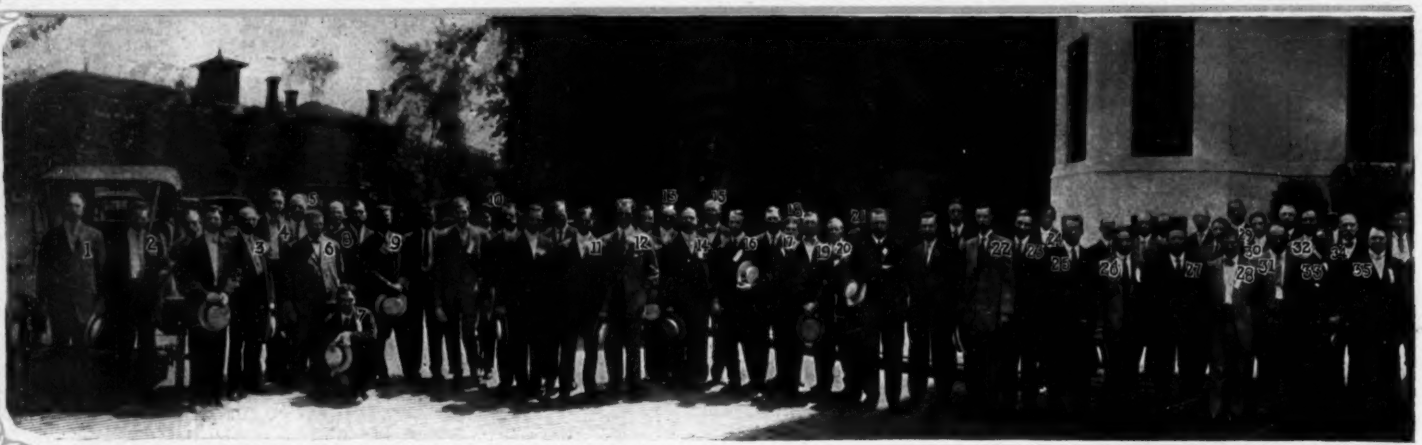
board of engineers, who should devote time, effort and ingenuity toward the solution of the puzzling maze of mechanical problems that confronted the manufacturers.

With this idea in view, the companies assigned engineers from their plants to organize what was subsequently known as the Mechanical Branch. Under the administration of Coker F. Clarkson, assistant general manager of the association, this body of engineers labored to perfect and standardize automobile construction. After several years of usefulness, this branch grew to be of such great size and importance that it was deemed advisable to segregate its work from that of the association proper. The senior engineering body affiliated with motordom was the Society of Automobile Engineers, composed of the flower of engineering thought.

When the time came for the Mechanical Branch to separate from its parent body, it was merged with the S. A. E., and to-day the combination represents concretely the firing-line of automobile construction.

The Selden patent, which constitutes the basis upon which the A. L. A. M. has been reared, was granted in 1895 and has about two years more to run. Almost as soon as the automobile industry assumed a position that pointed significantly toward a great future the patents were called into question. The litigation, which has been carried from the trial courts to the United States Circuit Court of Appeals, is now in the hands of the latter body for final decision.

This may be announced almost any day and is awaited with intense interest by all motordom.



1, J. A. Crowley; 3, H. M. Swetland; 4, H. G. McComb; 5, D. F. Graham; 6, E. J. Stoddard; 7, H. H. Brown; 8, H. F. Donaldson; 9, G. W. Vaughan; 10, G. W. Gaidzik; 11, J. J. Aull; 12, F. H. Berger; 13, G. E. Merryweather; 15, H. Souther; 16, Fred Tone; 17, B. B. Neuteboom; 18, J. Coapman; 19, M. A. Hall; 20, A. Holmes; 21, H. B. Anderson; 22, F. D. Howe; 23, T. V. Buckwalter; 24, Bentley; 25, H. G. Chatain; 26, E. T. Birdsall; 27, J. P. Lavigne; 28, A. M. Dean; 29, A. C. Bergman; 30, Smith; 31, W. H. Van Dervoort; 32, H. K. Holsman; 33, H. Vanderbeek; 34, McGeorge; 35, C. F. Clarkson.

National Association of Automobile Manufacturers

BEING the senior trade association of American motordom, the National Association of Automobile Manufacturers, with headquarters at 7 East Forty-second street, ranks high as a potential force. This body was formed something over ten years ago, when the automobile was a rarity, especially the American made motor car.

In those early days the need of some sort of a national organization became apparent, and it was formed without any such special concrete tie as the Selden patents to center the community of interest of its membership upon.

In watching the trend of trade; lending assistance with advice and counsel to manufacturers; carrying on shows and exhibitions, and in a dozen other directions, this association has been an active element in bringing about the vogue of the automobile.

After existing as a voluntary, unincorporated body for several years, the association was formally incorporated in 1904, and in that shape it exists to-day. Its avowed objects are to protect, promote, further and advance the interests of its members and allies. The actual work of the association is little heard of, but it is, nevertheless, a potent force. As the power behind great civic movements associated with the automobile and its use, the association has borne its part.

Its membership is countrywide, and its influence is international. The men who formed the association, nearly all of whom are still prominently affiliated with it, include the following leading makers of automobiles: S. T. Davis, Jr., Windsor T. White, Charles Clifton, Percy Owen, Roy D. Chapin, S. D. Waldron, J. Wesley Allison, Charles E. Duryea, William R. Innis, L. H. Page, M. J. Budlong, E. H. Cutler, Albert L. Pope, G. W. Bennett and M. L. Goss.

Of these, Mr. White was first president under the incorporation. Samuel A. Miles, general manager of the association, has been one of the principal factors in its growth and development.

The present officers include the following: L. H. Kittridge, president; William E. Metzger, first vice-president; C. C. Hildebrand, second vice-president; Benjamin Briscoe, third vice-president; H. O. Smith, secretary, and William R. Innis, treasurer.

It is confidently predicted that the activities of the association this year will be on a more extended basis than ever; the preparation for the National show will demand a vast amount of attention. How all the demands made upon the officials will be met is a problem that remains to be solved. Then, there are other matters that are constantly receiving the attention of the association, so that the functions of this body are necessarily active, and it is not too much to say that it is something of a task to maintain them in good working order.

H. T. DUNN
Vice-President

WILLIAM M. SWEET
General Manager

D. J. POST
First President of the Organization

F. E. CASTLE
Second Vice-President

36, H. E. Coffin; 37, L. W. Whitcomb; 38, T. J. Fay; 39, G. E. Franquist; 40, F. P. Nehrbas; 41, D. T. Brownlee; 42, H. H. Kennedy; 43, C. W. Hatch; 44, G. W. Dunham; 45, D. Fergusson; 46, H. J. Edwards; 47, H. K. Thomas; 48, B. Ford; 49, Kendall; 50, V. G. Apple; 51, W. P. Kennedy; 52, Bowman; 53, Steele; 54, Baker; 55, W. F. Abel; 56, Kirwan; 57, W. Graham; 58, M. T. Lothrop; 59, Fullick; 60, J. A. Mathews; 61, Welfare; 62, B. Bailey; 63, Marburg; 64, Stern; 65, W. H. Staring; 66, A. J. Slade; 67, W. C. Baker; 68, H. W. Alden; 69, Hinkley; 70, W. H. Cameron; 71, H. S. Baldwin; 72, A. L. Dixon; 73, B. A. Gramm.

Society of Automobile Engineers

TRULY national in its scope and disinterested in its operation, the Society of Automobile Engineers has a field for accomplishment that is unique in its breadth and importance.

In the widest sense the society is a clearing-house for engineering practices. It was founded upon a creed of the highest ethical character and never has been trammeled and hindered with commercial limitations. It is free to search to the foundations; to experiment, discuss and to formulate opinions, which afterward have crystallized into conclusions that have been accepted by makers.

While the automobile is still an innovation and subject to still further improvement, it may be said that the labors of the S. A. E. have proved effective in suggesting and urging many of the features of construction that are now regarded as standard, but which were revolutionary when they were given birth. When the ultimate standard has been set, the work of the society along the lines of standardization will be written in the mechanism of hundreds of thousands of perfected motor cars.

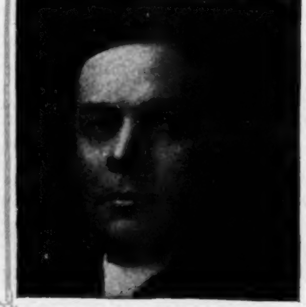
The society was formed in the Spring of 1905, when a handful of pioneers, progressive scientific men, called it into being. To-day, just completing its sixth year, it has a membership of about 600, representing the soul of the art of automobile engineering and yielding an influence that extends beyond the boundaries of the country.

Less than a dozen attended the preliminary meeting, and more than 500 are expected for the great convention that will be held January 11-12 at the Automobile Club of America.

A. L. Riker was selected as the first president of the society and at the end of his term was re-elected. His associates were such men as Henry Ford, John Wilkinson, E. T. Birdsall, A. H. Whiting, L. T. Gibbs, H. M. Swetland, H. P. Maxim, W. H. Alden and H. Vanderbeek.

Meetings were held semi-annually or oftener and the members delivered lectures and addresses upon every conceivable subject connected with automobile engineering. The features of construction that most nearly approximate the standard in modern practice have resulted, almost without exception, from the deliberations and experimentation of members of the society. As a single instance of that sort, it may be recorded that it was the work of the society that brought about the use of alloyed steel in motor car manufacture.

But to specialize upon the activities of the society is almost futile in view of the broad field it is maintaining a proper place in, and until the automobile, as an economic machine, has reached its last stages of perfection there will be work for the society to do, and plenty of it. Just now the program is full, too full perhaps for comfort, and when the mantle falls upon the last days of 1911 there are few of the members who believe that the automobile industry will be without a standard to go by.



C. M. HALL
Director M. and A. M.

W. S. GORTON
Treasurer M. and A. M.

C. T. BYRNE
Director

H. W. CHAPIN
Director

Thomas J. Fay was elected president upon the conclusion of Mr. Riker's second term, and he was succeeded by Henry Hess. Howard E. Coffin, President of the Hudson Motor Car Company, was selected as leader at the last annual meeting, and his successor will be chosen during the forthcoming session.

The growth of the society was steady during its early years, keeping about one good pace in advance of the industry. There was real work done during those first years. Ideas, materials, combinations were tried out with painstaking accuracy after close research Some were accepted; some rejected; some merely reported upon for subsequent consideration and further research.

It was only a short time before the work of the society began to attract deserved attention in Europe by the impartial character of its investigations. When motor manufacture had taken its place as one of the leading industries of the United States, the society had attained a size and dignity commensurate with it.

But it was not until 1910 that the society reached its full growth. With one bound it gained hundreds of members. In part this great accession to the rolls was the result of the absorption of the Mechanical Branch of the A. L. A. M. The work of that organization had increased to such an extent in scope, volume and importance that it was deemed advisable to separate the branch from the A. L. A. M. and affiliate it with a disinterested organization, where it could be in close touch with the most advanced thought on the subject of automobile engineering.

Thus it came about that the big department of the licensed association was merged with the S. A. E., which heretofore had declined to entertain even the most complimentary offers of affiliation with other societies.

This attitude was assumed toward the other societies because the S. A. E. held that the candidates for merger, from the very nature of the societies, were only interested in the automobile from the academic viewpoint, while the society itself was the essence of practicability.

The work of the society, as at present outlined, is super-technical. Generalities have no place in its deliberations. Its programs are filled with detailed papers on the most minute ramifications of theory and practice. The men selected to make the addresses show by the results that they have delved deep into original research in exhausting their subjects. For instance, the change in position of a non-essential part was given prominence in one session where the main subject under consideration was the use of alloyed steel, at a time when there was no alloyed steel used in American construction.

To-day that particular non-essential part has been changed in position in accordance with the views of the engineer who presented the paper, and the field of alloyed steel is almost as wide as the industry.

The present officers of the society, aside from Mr. Coffin, are: Henri C. Chatain, first vice-president; R. C. Carpenter, second vice-president; A. H. Whiting, treasurer, and Coker F. Clarkson, formerly assistant general manager of the A. L. A. M., and head of the Mechanical Branch, is general manager.

The approaching meeting of the society is expected to prove the most important in its history to date. It will be larger than any ever held in the past and the program covers a half dozen sessions, each of which will be made attractive to the engineers by a series of interesting papers to be delivered by eminent members in each line of research. The attendance will be at least three times the size of the membership present at any previous annual meeting of the society, and the character of the discussion will be in the nature of a confirmation of standardization work, hence of great importance.

Motor and Accessory Manufacturers

CHIEF among the most effective organizations of motordom is the Motor and Accessory Manufacturers' coalition. This body comprises 223 firms, representing a capitalization of about half a billion dollars, and noted internationally as one of the strongest trade associations of modern civilization. The M. and A. M. has headquarters at 17 West Forty-second street, New York City, where an adequate suite of offices is maintained for the administration of the association as well as the convenience of its members.

The membership is limited to firms, corporations and individuals engaged in the making of motors, parts, appliances and accessories.

Among its advantages to its membership may be noted the following: A credit department, based upon data contained in actual reports from its constituent members, which embrace a scope almost as wide as the automobile trade. The national automobile shows are managed and governed in an associate manner, with a powerful voice in such management exercised by the association. It underwrites the space allotments set off to the makers of accessories and sublets the same. In doing this it plays an important part in bringing its members together on a basis of fraternity, and while it makes no feature of exploiting show benefits, it claims to afford some opportunities toward economy.

The association conducts a trade information bureau for the dissemination of inside information to its membership, some of which is said to be of the highest value. A legal department is also maintained for the use of members, in an advisory sense. Naturally enough such a department does not contemplate the service of counsel in the matter of bringing private suits or defending them, but the department is at the call of members who desire legal opinions as to pertinent matter.

The association was formed in March, 1904, and is incorporated under the Connecticut laws. Its machinery consists of a board of twelve directors and a number of officers, all of whom serve without pay. The only salaried official is the General Manager, William M. Sweet, who has an adequate force of clerks at his disposal.

The present officers include the following: H. E. Raymond, president, Akron, O.; H. T. Dunn, first vice-president, Chicopee Falls, Mass.; F. E. Castle, second vice-president, Detroit, Mich.; C. E. Whitney, third vice-president, Hartford, Conn.; W. S. Gorton, treasurer, Cleveland, O.; P. S. Steenstrup, secretary, Newark, N. J.; C. M. Hall, Detroit; D. J. Post, Hartford; C. T. Byrne, Kokomo; H. W. Chapin, Syracuse; E. S. Fretz, Pottstown, Pa., and L. M. Wainwright, Indianapolis, members of the executive committee, completing the board.

Mr. Post was first president, being succeeded by Mr. Chapin, who in turn was succeeded by Mr. Post in 1906. Then H. S. White occupied the presidency for two years, and was followed by the incumbent, H. E. Raymond, who has served two terms. Mr. Gorton has served as treasurer ever since the formation of the association. The first meeting was held in Chicago, when thirty-nine concerns signed the membership roll as charter members. Of the original thirty-nine, there are still twenty-seven holding active part in the organization and the fine team work which is now being done indicates very clearly that the body as a whole is progressively active, which not only shows that the original 39 members have the right idea in mind, but that those who came in later were in full accord with the tenets of the organization.

STATISTICS

VARIOUS estimates of the total number of automobiles in this country have been made and published from time to time. In view of the wide divergence of the figures given, ranging from several hundred thousand to more than a million, an investigation was recently made to determine with a fair degree of accuracy, if possible, the actual number of cars that are registered in the several States, from which it may be inferred that they are in actual use for a part of the year at all events. Before examining the tabulation that was made from the canvass of the States it will be worth something to the reader to become familiar with the distribution of the plants that are devoted to the manufacture of automobiles, and the output, as it is estimated at the present time, but while the opportunity is up perhaps it will be well to compare the output for a number of years, thereby noting the rate of growth of the automobile industry.

THE 1911 GEOGRAPHICAL DISTRIBUTION OF PLANTS COMPARED WITH THE 1910 DISTRIBUTION

	Plants	
The States	1910	1911
Michigan	42	61
Indiana	31	40
Ohio	29	60
New York	26	54
Illinois	24	30
Pennsylvania	17	31
Massachusetts	15	29
Wisconsin	14	19
Connecticut	9	27
Missouri	8	12
Minnesota	5	2
New Jersey	3	10
Maryland	3	2
Iowa	2	1
Scattered	6	..
Totals	234	378

The chart on page 15 of THE AUTOMOBILE, this week, has been constructed with the greatest care for the purpose of depicting the growth of the industry as shown by the number of automobiles produced since 1893, and as an indication of the state of the art prior to that date the charting of the automobiles that were registered in the State of New York beginning with 1891 and ending with 1894 will be a sufficient indication of the prevalence of cars in America during that period, it being true that there were relatively few automobiles in use during these years.

The value of the automobiles produced by the plants by States:

ESTIMATED VALUE OF THE 1911 PRODUCT

By States	Number of cars	Value of cars
Michigan	18,059	$30,545,534.37
Indiana	10,519	17,791,152.27
Ohio	32,460	54,901,817.80
New York	57,779	97,730,243.97
Illinois	27,338	46,130,333.34
Pennsylvania	32,722	55,346,972.46
Massachusetts	22,824	37,211,460.00
Wisconsin	5,576	10,731,421.68
Missouri	15,600	27,386,308.00
Minnesota	11,900	20,168,027.00
New Jersey	34,078	57,640,561.54
Maryland	4,526	7,645,422.18
Iowa	10,302	17,425,111.86
Scattered	156,996	1,056,331,143.28
Totals	440,729	$1,536,985,509.75

NOTE.—The price per automobile, as figured in this tabulation, is slightly above the average price per car as shown in the chart, and the difference is enough to pay for the extra tire case and inner tubes that are invariably purchased with an automobile.

In the distribution of the automobiles in actual use there probably are a considerable number of details that would prove to be of more than passing interest could they be properly tabu-

lated. Many questions might be asked as to what proportion of the high-priced automobiles goes to the several districts and what is the effect of speed and power on the life of the automobiles? But there is one overpowering situation that will have to be dealt with in the long run, and when the proper remedy is applied statistics will look better than they do to-day; in other words, what is to be done with the worn-out automobiles and who will decide as to when an automobile is rendered *hors de combat?*

AUTOMOBILES IN ACTUAL USE IN THE SEVERAL STATES

†Alabama	4,800	Nebraska	13,019
†Arizona	800	†Nevada	890
†Arkansas	1,900	New Hampshire	3,600
California	9,966	New Jersey	34,078
†Colorado	6,000	†New Mexico	800
*Connecticut	10,500	‡New York	57,779
Delaware	899	North Carolina	3,116
*District of Columbia	6,030	†North Dakota	1,500
Florida	2,085	Ohio	32,460
†Georgia	4,250	†Oklahoma	1,041
†Idaho	750	Oregon	2,264
*Illinois	27,878	*Pennsylvania	32,722
Indiana	10,519	Rhode Island	5,503
Iowa	10,302	South Carolina	4,407
†Kansas	12,300	South Dakota	7,604
Kentucky	2,299	Tennessee	4,062
†Louisiana	6,850	†Texas	8,400
Maine	2,322	Utah	1,491
*Maryland	4,526	Vermont	3,223
Massachusetts	22,000	Virginia	6,969
Michigan	18,059	Washington	6,013
Minnesota	11,900	West Virginia	1,077
Mississippi	6,300	Wisconsin	5,576
Missouri	15,600	†Wyoming	1,100
†Montana	3,200		
		Total	440,729

*This includes residents and non-residents.
†Estimated. No State (or Territorial) license required.
‡Licenses under new law.

SUMMARY OF GARAGES AND REPAIR SHOPS BY STATES

STATES	Car Dealers	Garage*	GarageQ	Repair Shops	Supply Stores	Total States
Alabama	51	30	10	2		93
Arizona	23	13	3			39
Arkansas	29	13	5	1		48
California	478	302	52	35	27	894
Colorado	102	57	17	5	7	188
Connecticut	188	148	17	16	11	380
Delaware	25	15	3	1		44
Florida	69	43	5	4		121
Georgia	152	58	19	6	4	239
Idaho	12	10				22
Illinois	748	470	78	74	34	1404
Indiana	405	229	24	40	5	703
Iowa	426	176	19	19	1	641
Kansas	242	150	13	7	3	415
Kentucky	83	39	14	1	2	139
Louisiana	54	20	7	2	1	84
Maine	85	66	6	4	3	164
Maryland	61	46	4	5	4	120
Massachusetts	293	314	42	70	40	759
Michigan	328	214	27	24	23	616
Minnesota	260	136	18	11	10	435
Mississippi	43	19	2	3		67
Missouri	257	108	28	29	14	436
Montana	51	31	1		1	84
Nebraska	185	135	13	7	5	345
Nevada	6	7				13
New Hampshire	57	51	7	8		123
New Jersey	285	272	31	33	6	627
New Mexico	14	14			1	29
New York	857	231	95	95	86	1364
North Carolina	41	27		9		77
North Dakota	125	67		2		194
Ohio	555	303	84	56	23	1021
Oklahoma	107	53	5	7	1	173
Oregon	71	40	3	5	7	126
Pennsylvania	516	409	56	34	26	1041
Rhode Island	63	57	7	10	7	144
South Carolina	68	36	1	4	2	11
South Dakota	95	56	2	2		155
Tennessee	68	35	4	2		109
Texas	251	91	18	20	2	382
Utah	30	9	4	1	2	46
Vermont	63	50	1	6		120
Virginia	81	46	5	5		137
Washington	118	56	13	5	6	198
West Virginia	43	17	6	1		67
Wisconsin	223	179	24	21	5	452
Wyoming	15	10		2		27
	8402	4958	793	694	369	15116

* Without electric charging facilities.
Q With electric charging facilities.

The table of automobiles in actual use, together with the summary of garages and repair shops, offers a ground for speculation bearing upon the money investment in the care and repair of automobiles, but the figures, as follows, which are fairly exact, are all that will be ventured in this direction:

Money investment by dealers (not including cars)	$58,940,000
Money investment in garages for gasoline cars	20,948,000
Money investment in electrically fitted garages	7,187,000
Money investment in repair shops	4,752,000
Money invested in supply stores	7,380,000
Money exchanged in the form of rentals to keepers of garages for the storage of automobiles	48,000,000
Money paid out for tire-renewals per year	20,000,000
Grand total of these items of money exchange	$167,207,000

How the Machine Tool Trade Has Fared

Manufacturing automobiles requires the use of a wide variety of the finest designs of machine tools, and when the industry first started it was found that the character of the tools that were ready to hand upon the market were not sufficiently substantial to serve the end. In automobile work the materials used are considerably more rigid than those which are current in other industries, and it is also true of automobile work that the fits of the parts are closer.

In the discussion of the economic problem it is the habit of those who seem to know a great deal about the industries, although they do not profess a direct connection with the automobile industry at any rate, to decry activity and to maintain that too much automobile is the curse of the land. Any one who is acquainted with the trade will fully understand what the automobile has done for the machine tool trade; back, during the panic days, when the machine tool trade was in the throes of bankruptcy it was the automobile industry that came to the rescue and enabled the makers of machine tools to weather the storm; more than this, the entire world of machine tools has been busy ever since on special tools for automobile plants.

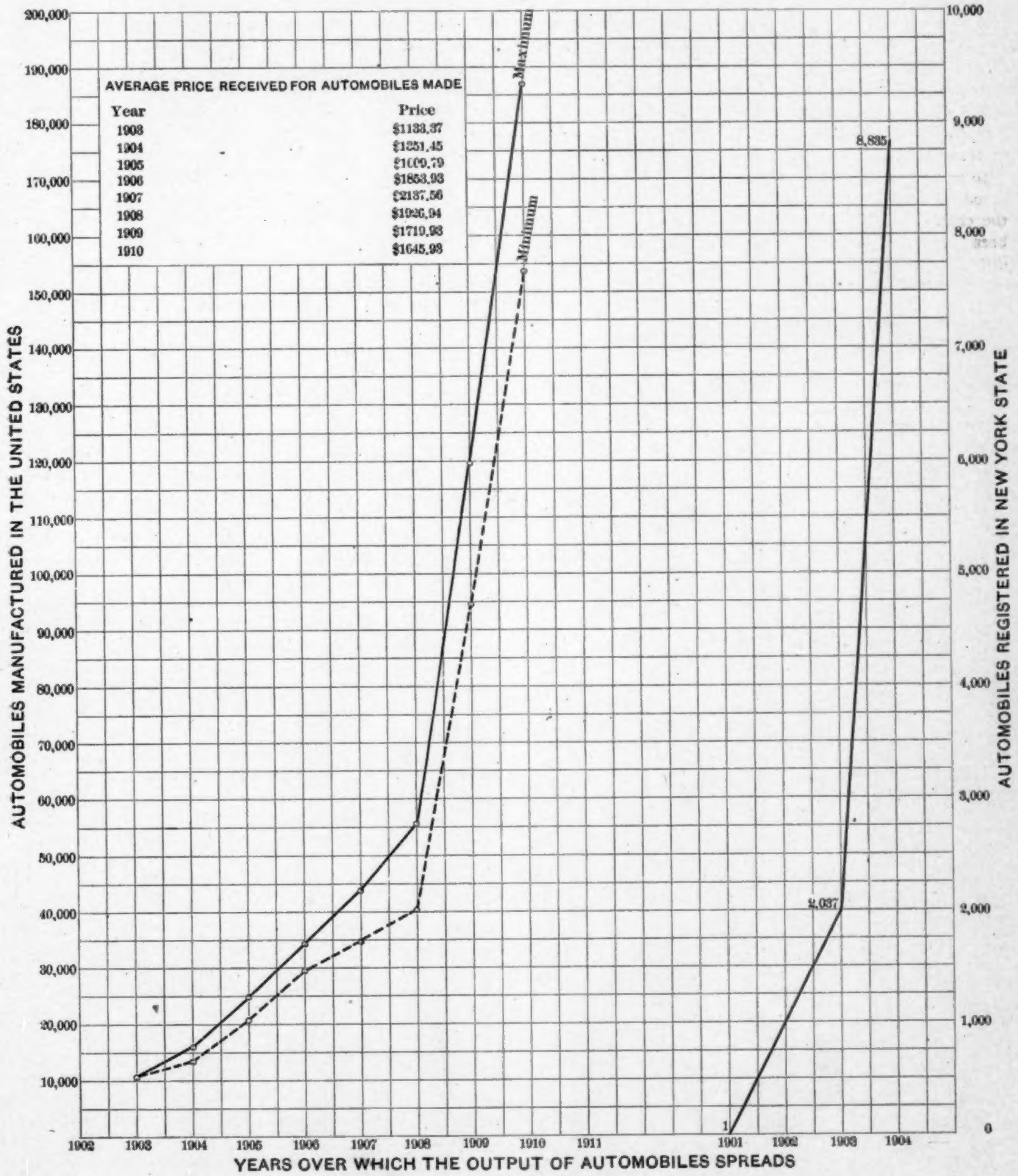
The tabulation as here afforded shows something of the cost to the automobile industry of the machine tools that have been purchased from time to time, they being about the number and types that will be necessary in the turning out of 200,000 automobiles. But even these figures fail of the purpose; if a machine tool is required to do a certain job it must also be remembered that the tool will not run without power, and as a general proposition it takes as much money to fit out to run a tool as it takes to acquire a title to it.

The list of tools given on page 17, footing up to the grand total of 134,170, does not include a variety of things that would have to be remembered in the fitting out of a plant, nor will it be possible to estimate, with any degree of accuracy, the power required to drive these tools. It will be remembered that the lighting question is invariably taken up with the power, using electrical machinery, to a large degree, for both. As a general proposition, as plants go, the machinery does not occupy more than a third of the total space, and allowing 100 square feet per tool, which is little enough, considering the space not occupied by tools, the grand total of space foots up to the enormous area of 40,-251,000 square feet. This area represents 924 acres of floor space.

Allowing one 16-candlepower electric light for each 100 feet of floor surface, which is a good allowance if the lighting is not to be too brilliant, it means that fully 400,000 lamps must be used, requiring 40,000 horsepower to do this work alone, provided all the lamps are burning at one time. Fortunately, not more than 25 per cent. of all of these lamps will have to be lighted at one time, taking an average condition, so that the power question resolves down to about 10,000 horsepower for lighting, and this figure is not far from the truth as it obtains in the plants at the present time. To this power must be added the power required to drive the machine tools, and while it will be impossible to state definitely as to the total of the power, it would seem, from statistics gathered, that a round figure might be approximately 30,000 horsepower average for nine hours

CURVES PLOTTED TO INDICATE THE GROWTH OF THE AUTOMOBILE INDUSTRY

Curve plotted to show at a glance the number of automobiles that were manufactured in the United States during each year between 1902 and 1911, in which the solid line to the left tells of the total of the cars from all quarters, including the scattered products, and the dotted line indicates with considerable precision the automobiles that were made of which definite information is available. The solid line to the right refers to the automobiles that were registered in the State of New York, beginning January 1, 1901, to January 1, 1904. The tabulation at the top gives the average price received for the automobiles sold during the years embraced. The information upon which these curves stand has been gathered with great care, and it is believed that this is a very close approximation of the manufacturing side of the automobile industry.



AVERAGE PRICE RECEIVED FOR AUTOMOBILES MADE

Year	Price
1903	$1133.37
1904	$1251.45
1905	$1609.79
1906	$1853.93
1907	$2137.56
1908	$1926.94
1909	$1719.93
1910	$1645.93

per day, 300 days per year. To sum up, then, let it be assumed that the estimates here are fairly representative of the real situation, and that 40,000 horsepower are required from power plants to run the machinery and light the plants. The value of a horsepower per year depends upon how it is generated and the location of the generating plant, but it is probable that $30 per horsepower is a good average figure. This means that $1,200,000 must be paid out every year for coal, oil, labor and supplies to maintain the power plants that are connected with the manufacturing of automobiles.

The value of the power plants, not counting the buildings and real estate, will be close to $3,200,000.

On top of this value is the cost of the electrical equipment required and used. The dynamos employed for lighting represents a round $1,000,000; the generators needed for furnishing electricity to motors will make $2,000,000 more, at least; this figure would be higher were it not for the fact that quite a large amount of the transmission work is done by belting and shafting, but there is easily $1,000,000 worth of this character of equipment in actual use in the plants.

In trying to show how the automobile business has pumped new blood into a vast number of lagging industries, there is always the chance of overdoing it, but the fact remains that good has been done in many quarters. Take the cement industry, for illustration. It has been benefited to the extent of $600,000 for cement that was used in the making of floors alone. What the industry has done for the building trade it is difficult to estimate, nor will the attempt be made at this time.

Who would care to go on record as saying that this increase is not directly due to the growth of the automobile business in and around the city of Detroit? Of course, it would be highly improper to set up the contention that the automobile business is responsible for an increase in population, but it can be said that it is responsible for the prosperity of great industrial centers like Detroit, and that the men and their families in Detroit are less happy than those who are slaving in the cotton mills of Rhode Island is scarcely to be believed. From what has been said it is proper to add that those who support the automobile business, while they get more than a little pleasure and sane recreation out of it, are also doing a great work, although it probably was beyond their planning.

In the meantime the roads of the country are being improved; the farmer is now within traveling distance of the nearby city; he likes his calling better and anything that will keep the farmer's son close to the ground will solve the problem of high living. Those who rant about the tariff wall, the trust, and the other aggregations, fail, utterly, to grasp the situation. If the farmer deserts his calling; if his sons hike it Broadway-wards; if the farmer's daughter takes up her abode in the city, it is this set of conditions that will make potatoes, corn, wheat, beef, pork, and other provender, high; too high to get over a tariff wall or into the home of the workman of small income. The automobile is doing away with this mal-condition; the time is rapidly approaching when every man and his family will prefer living in the country; the city will be brought so near to all that a matter of ten miles over good roads will be like living within a stone's throw of all that city life holds that is attractive to the man whose mind is clear, and who knows the man who is so con-

TABULATION OF THE AUTOMOBILE AND ACCESSORY INDUSTRY, SHOWING HOW THE BUSINESS IS S

STATES	Aluminum, Brass and Bronze Castings	Autos, Gasoline, Passenger	Autos, Gasoline, Freight	Autos, Electric and Steam Passenger	Autos, Electric and Steam Freight	Bearings, Ball and Roller	Bodies	Brakes	Carbureters	Clutches	Cylinders	Die, Steel and Malleable Iron Castings	Differential Gears
Alabama													
Arkansas													
California							3						
Colorado		1	1	1			1						
Connecticut	21	5		1		3	14	1	2	3	1	5	
Delaware							3					1	
Georgia		1											
Illinois	14	10	4	2		4	14		7	2		5	4
Indiana	13	25	1	1			23		7	5	1	6	2
Iowa		1					1						
Kansas		1											
Kentucky							2						
Louisiana													
Maine									2				
Maryland		1	1				1		1				
Massachusetts	19	4	4	2		2	24		9	2		7	
Michigan	24	32	1	2	2	5	31		7	2		9	4
Minnesota		1	1				1		2				
Mississippi													
Missouri	5	6	1				7		3			1	
Nebraska													
New Hampshire	1					1			1				
New Jersey	7	2			1		15		4			5	
New York	26	14	8	2	4	10	47		16	2	1	23	5
North Carolina													
North Dakota													
Ohio	28	18	5	7	2	3	20	1	2	4	1	10	2
Oregon													
Pennsylvania	18	6	6		1	5	22	2	3	3	1	17	
Rhode Island	6	2	1			1			1				1
South Carolina													
South Dakota													
Tennessee	1	1							1				
Texas													
Vermont									1				
Virginia													
Washington													
West Virginia													
Wisconsin	7	6	6				9		1	3		13	1
Wyoming													
Total Categories	190	137	40	18	10	34	238	4	70	26	5	102	19

STATES	Drop Forgings	Dry Batteries	Electric Light'g System and Access.	Frame, Pressed Steel	Gauges	Generators and Tanks	Gray Iron Castings (Cylinders)	Horns and Horn Accessories	Ignition Sundries	Indicators	Inner Tubes	Jacks	Joints
Alabama													
Arkansas													
California					4				1				
Colorado													
Connecticut	10	2	22		12	1	11	9	19	5	2		6
Delaware													
Georgia									1				
Illinois	7	3	33		8	3	5	9	27	6		9	2
Indiana	6	1	3	1	1	1	9	2	22	2	1	1	3
Iowa	2					1			1			1	
Kansas													
Kentucky							1						
Louisiana													
Maine			1				1	1	1				
Maryland													
Massachusetts	7	3	11		53	4	5	3	99	7	3	1	3
Michigan	11		17	1	8	3	11	1	35		1	1	7
Minnesota									2	1			
Mississippi													
Missouri		1	3		3		1			1			
Nebraska													
New Hampshire					1		1						
New Jersey	2	3	7		7	1	5	3	18	1	10	3	1
New York	12	6	43	1	38	9	6	16	88	18	6	9	2
North Carolina													
North Dakota													
Ohio	15	3	17	3	10	4	12	5	34	1	8	11	3
Oregon													
Pennsylvania	12	1	5	2	14	3	9	4	16	6	2	2	1
Rhode Island	1		1						5				
South Carolina									1				
South Dakota									1				
Tennessee													
Texas													
Vermont						1			1				
Virginia	1												
Washington													
West Virginia													
Wisconsin	2	1	10	1	3	1	7	3	15	1	2	3	1
Wyoming													
Total Categories	88	24	173	9	162	32	84	56	387	49	35	42	29

*Total gasoline automobile makes, 177. Total electric and steam automobile

stituted that his mind will not be as clear as a bell provided he takes a daily ride in an automobile?

Machine Tools Required to Build 200,000 Automobiles

Speed lathes	1,000
14-inch engine lathes	20,000
18-inch engine lathes	8,000
20-inch engine lathes	3,000
24-inch engine lathes	1,500
28-inch engine lathes	750
30-inch engine lathes	1,500
36-inch engine lathes	700
40-inch engine lathes	300
	36,750
30-inch vertical boring mills	750
36-inch vertical boring mills	200
40-inch vertical boring mills	70
48-inch vertical boring mills	50
	1,070
21-inch turret lathes	1,500
24-inch turret lathes	3,000
28-inch turret lathes	1,000
Miscellaneous special turret lathes	500
	6,000
Various horizontal boring machines	2,000
Special forms of boring bars	500
Lathe equipped boring bars	200
Simple boring bars	50
	2,750
No. 5 vertical milling machines	2,000
No. 6 vertical milling machines	2,000
Miscellaneous vertical milling machines	600
	4,600
Cylinder boring machines	1,500
Cylinder grinders	2,000
Cylinder valve grinding machines	400
Cylinder horizontal milling machines	1,200
Multiple spindle drills for cylinder work	500
30-inch radial drills in cylinder work	2,500
Miscellaneous special tools for cylinder work	900
	9,000
No. 2 milling machines	8,000
No. 3 milling machines	3,000
Hand milling machines	1,000
Special types of milling machines	600
	12,600
Miscellaneous sensitive drills	7,500
Miscellaneous small drill presses	8,000
Medium sized drill presses	5,000
Large drill presses	3,000
30-inch radial drills	1,500
36-inch radial drills	2,500
48-inch radial drills	1,000
Multiple spindle drills (various sizes)	900
	29,400
Special crankshaft machines	1,500
Crankshaft lathes	500
	2,000
Camshaft grinders	200
Crankshaft grinders	1,000
Piston ring grinders	150
Disc grinders	40
Various magnetic chuck grinders	110
Miscellaneous grinders (universal)	4,000
	5,500
Small sized screw machines	2,000
Medium sized screw machines	2,500
Large sized screw machines	5,000
Automatic screw machines	2,500
Miscellaneous screw machines	3,000
Multiple spindle screw machines	3,000
	18,000
Sand blasting machines	200
Muffle furnaces	800
Annealing furnaces	450
Miscellaneous forges	550
Electric furnaces	600
	2,600
Compressed air riveters	3,000
Sheet metal workers' tools	800
Miscellaneous special tools	600
	4,400

SINESS IS SPREAD OUT OVER THE COUNTRY AND THE BRANCHES OR RAMIFICATIONS THEREOF

nner Tubes	Jacks	Joints	Lamps (non-electric) and Accessories	Lubricators	Magnetos	Motors (Electric) and Dynamos	Motors (Gasoline)	Motors (Steam Engine)	Parts of Automobile	Pipes and Pipe Fittings	Pumps (Gasoline Oil, Fire and Water)	Radiators	Rims	Shafts (Propeller)	Shock Absorbers	Springs	Steering Gears	Storage Batteries	Tires	Tire Accessories	Tools	Tops	Transmission Gears	Valves	Wheels	Windshields	Miscellaneous	Total
													1						1		1						2	5
															2												1	3
			1																	3	1	2		2	1	1	11	30
																				1		2						7
2		6	7		4	1	1		10	1	5	4	1	2	2	7			2	14	247	4	1	2	2	5	454	931
																					2	1					5	12
																											2	4
	9	2	12	4	2	7	14		6	6	15	3	3		4	6	1	16	6	25	136	21	5	9	1	19	537	1036
1	1	3	3		10	2	15		11		7		3		1	4	4	4	8	16	69	11	19	1	5	6	222	558
	1																		1	4		2	1	1			15	30
																				1							3	5
			1				1	1									1			1	1	1					4	14
																											1	1
																					3						5	14
			2										1		1				1		1	3			2		20	35
3	1	3	17	1	4	2	4		5	5	4		2		7	5	4	5	4	27	261	24	3	11	3	5	951	1626
1	1	7	11	6	6	1	11		20	4	11	5	5		1	12	8	2	1	15	64	10	11	11	7	12	403	852
																		1	2	4	1	1				1	4	22
																											1	1
					1				2			1			2	3	1	4	1	5	29	6		2		6	86	182
																				3		1			1		5	10
						1															8						5	19
10	3	1	4	1	2	4	11		2	1	8	1	9	1	3		2		10	31	132	6		2	2	6	326	659
6	9	2	29	7	13	4	14	2	25	2	28	15	13		14	20	5	16	12	53	301	34	14	20	9	20	1247	2329
																											4	4
																											1	1
8	11	3	12	3	5	7	6		16	10	9	2	12		1	7	5	11	28	40	265	14	3	22	4	8	601	1320
											1		1															2
2	2	1	3	1	3	2	6		20	12	7	1	2			13	2	5	9	12	162	11	4	10	2	9	525	982
			1				1		1		1							1*		1	20		1	1			43	90
																				3							2	6
																												1
			3																	2							4	12
																			1	3		2					3	9
																1					7						6	17
																			1			2			1		6	11
																			1	1		1					4	7
			1							1																	2	4
2	3	1	2	4	2	1	17		7	2	4	1			2	2	3	4	5	7	35	10	4	3		6	96	313
			1																									1
35	42	29	110	27	52	32	101	3	125	44	100	33	53	3	40	80	36	69	94	272	1746	169	65	97	40	104	5607	11165

obile makes, 28. Grand total self-propelled vehicle makes, 205.

BALL, ROLLER AND PLAIN BEARINGS

177—The American Ball Bearing Co., Ball Bearings.
584—Barthel, Daly & Miller, Schafer Ball Bearings.
304—The Hess-Bright Manufacturing Company, Ball Bearings.
234—New Departure Manufacturing Company, Ball Bearings.
615—R. I. V. Company, Ball Bearings.
163—Standard Roller Bearing Company, Bearings.
166—The Timken Roller Bearing Company, Roller Bearings.

BODIES AND FITTINGS

549—Ajax Trunk and Sample Case Company, Trunks.
271—C. Cowles & Co., Auto Hardware.
409a—F. H. Kelsey & Co., Auto Lever Lock.
324—North & Judd Manufacturing Company, Auto Hardware.
193—Springfield Metal Body Company, Bodies.

CARBURETERS AND OTHER GASOLINE EQUIPMENTS

191—S. F. Bowser & Co., Inc., Tanks.
407—L. V. Fletcher & Co., Carbureters.
571—Findeison & Kropf Mfg. Co., Carbureters and Ignition.
516—Gyrex Manufacturing Company, Gas Economizer.
261—The Homo Company of America, Gasoline Economizer.
507—Hydraulic Oil Storage Company, Gasoline Storage.
606—A. J. Myers, Inc., Carbureters.
311—Reichenback Laboratories Company, Carbureters.
622—Alfred C. Stewart Machine Works, Carbureters.
243—Stromberg Motor Devices Company, Carbureters.
145—Wheeler & Schebler, Carbureters.

DROP FORGINGS, PRESSED STEEL AND LIKE FABRICS

276—The Carpenter Steel Company, Crucible Steel.
285—Crucible Steel Company of America, Steel.
535—Dekcampe Welding Co., Oxy-acetylene Welding.
313—Dover Stampings and Machine Company, Stamped Accessories.
410—H. A. Elliott, Drop Forged Crankshafts.
564—Peter A. Frasse & Co., Metal Importer.
274—The Globe Machine and Stamping Co., Stampings.
601—International Engineering Co., Steel Importers.
417—Metal Stamping Company, Stampings.
402—Motor Parts Company, Stanwood Steps.
138—National Tube Company, Steel Tubing.
412—Philadelphia Steel and Forge Company, Drop Forgings.
599—Thos. Prosser & Son, Steel Importers
137—A. O. Smith Company, Frames
176—Standard Welding Company, Electric Welding.
320—The United Steel Co., Steel.
591—U. S. McAdamite Metal Company, McAdamite.
312—Vanadium Metals Co., Vanadium.
321—Vanadium Sales Co., Vanadium.
314—Western Tool and Forge Co., Heat Treatment Specialties.
173—J. H. Williams & Co., Drop Forgings.

GAS, ELECTRIC AND KEROSENE LIGHTING EQUIPMENTS.

239—Apple Electric Company, Lighting Dynamos and Batteries.
126—The Badger Brass Manufacturing Company, Lamps.
575—B & L Auto Lamp Company, Lamps.
181—Castle Lamp Company, Lamps.
189—R. E. Dietz Company, Lamps.
157—Edmunds & Jones Manufacturing Company, Lamps.
594—Elliott Auto-Lighter Company, Lamp Fittings.
130—Gray & Davis, Lamps.
532—Hofacker Manufacturing and Supply Co., Short Coupled Lamps.
553a—Luce Manufacturing Company, Lamp Brackets.
425—Motor Specialties Company, Flash Auto Lighter.
133—National Carbon Company, Dry Batteries and Lighting Outfits.
518—North East Electric Company, Lighting Outfits.
559—Fred Robinson, Tail Lights.
418—Rushmore Dynamo Works, Lamps.
150—The U. S. Light and Heating Company, Batteries.
573—Ward Leonard Electric Company, Lighting Outfits.

GENERAL AUTO SUPPLIES

616—B. M. Asch, Jobber.
422—Baker Sales Company, Accessories.
592—Gus Balzer, Accessories, Air Tanks.
269—Briggs & Stratton, Accessories.
572—The Brown Company, Sundry Accessories.
603—Frank A. Cross Distributing Company, Jobbers.
604—Chas. J. Downing, Jobber.
514—C. F. Ernst's Sons, Turntable Wash Rack.
605—The Eagle Company, Jobbers.
556—Julius King Optical Company, Goggles.
531—G. B. Lambert.
161—Chas. E. Miller, Supplies.
158—Morrison Ricker Company, Gloves.
562—The Motor Car Equipment Company, Jobbers.
500—New York Sporting Goods Company, Jobbers.
550—Post & Lester Company, Jobbers.
519—W. E. Pruden Hardware Company, Jobbers.
540—Randerson Auto Parts Company, Jobbers.
424—Randolph & Company, Imported Auto Caps and Haberdashers.
545—Joseph Tracy, Testing Laboratory.
530—Union Auto Specialties Co.
515—Wycroff Lumber and Manufacturing Co., Portable Garages.

Garden Accessory Exhibits

HEADQUARTERS OF THE AUTOMOBILE PUBLICATIONS

504—The Automobile.
596—Automobile Topics.
600—Chilton Company, Cycle and Automobile Trade Journal.
558—The Horseless Age.
555—Motor.
505—Motor Age.
551—Motor Print.
552—Motor Vehicle Publishing Company.
561—The Motor World.
593—New England Automobile Journal.

LUBRICANTS AND LUBRICATING DEVICES

318—Atlantic Refining Co., Oils.
534—Bliven & Carrington, Inc., Lubricants.
223—Columbia Lubricants Company of New York, Oils.
157a—Adam Cook's Sons, Oils and Greases.
182—Joseph Dixon Crucible Company, Graphite Lubricants.
162—A. W. Harris Oil Company, Oils.
303—Havoline Oil Company, Oils, Etc.
512—The R. M. Hollingshead Co., Polishes, Oils, Soaps, Greases.
260—George A. Haws, Panhard Oil.
612—Keystone Lubricating Company, Lubricants.
565—Wm. P. Miller's Sons, Oils and Greases.
141—N. Y. and N. J. Lubricants Company, Oils and Greases.
521—The Philadelphia Grease Manufacturing Company, Lubricants.
524—L. Sonneborn Sons, Inc., Lubricants.
185—Vacuum Oil Company, Oils and Greases.
544—The Wayne Oil Tank and Pump Company, Tanks and Pumps.
316—The White & Bagley Company, Oils.
293—Orlando W. Young, Oils.

MACHINE TOOLS

309—Frost Gear and Tool Machine Company, Machine Tools.
570—The Walter H. Foster Company, Radial Drills.

MAGNETOS, COILS, TIMERS AND OTHER IGNITION DEVICES

242—America Ever Ready Company, Dry Cells and Elect. Fittings.
281—Atwater Kent Manufacturing Company, Unisparkers, Coils.
419—E. M. Benford, Spark Plugs.
405—Best Ignition Company, Spark Plugs.
224—Bosch Magneto Company, Magnetos.
586—J. S. Bretz Company, Magneto U. & H.
291—Briggs Manufacturing Company, Magnetos.
627—Champion Ignition Co., Ignition Apparatus.
152—The Connecticut Tel. & Elect. Co., Inc., Magnetos.
257—The Edison Storage Battery Company, Batteries.
229—Eisemann Magneto Company, Magnetos.
227—The Electric Storage Battery Company, Batteries.
510—Garage Equipment Company, Gem Spark Plug Wrench.
513—Giesler Bros. Storage Battery Co., Batteries.
264—R. E. Hardy Company, Igniters.
184—Heinze Electrical Company, Magnetos.
190—Herz & Co., Magnetos.
560—The H. M. S. Auto Switch Company, Electrical Fittings.
576—Jeffery Dewitt Company, Ignition Apparatus.
174—Kokomo Electric Company, Spark Plugs.
624—K-W Ignition Company, Magnetos.
581—K & W Manufacturing Company, Ignition Apparatus.
159—J. H. Lehman Manufacturing Company, Magnetos.
590—The Lutz Lockwood Manufacturing Company, S. X. Magnetos.
307—Marburg Brothers, MEA Magnetos.
179—A. R. Mosler & Co., Spark Plugs.
266—National Coil Co., Coils.
574—New York Coil Company, Inc., Coils, etc.
168—The Pittsfield Spark Coil Company, Coils.
147—Remy Electric Company, Magnetos and Coils.
587—The Simms Magneto Company, Magnetos.
129—C. F. Splitdorf, Magnetos.
233—Vesta Accumulator Company, Batteries.
310—The Willard Storage Battery Co., Storage Batteries for Automobile Lighting.
277—Witherbee Igniter Co., Batteries, Magnetos.

MOTORS, TRANSMISSION SYSTEMS, STEERING GEAR AND AXLES

567—Atlas Chain Company, Chains.
135—Baldwin Chain and Manufacturing Company, Chains.
170—Brown Lipe Gear Company, Gears.
415b—Calmon Asbestos and Rubber Company, Brake Linings.
409—A. U. Campbell.
154—Columbia Nut and Bolt Company, Inc., Nuts and Bolts.
139—Diamond Chain and Manufacturing Company, Chains.
253—Driggs-Seabury Ordinance Corp., Motors, Transmissions, etc.
246—Excelsior Motor and Manufacturing Company, Motors.

GIVING THE NAME OF EACH EXHIBITOR OF ACCESSORIES, AND THE NUMBER OF THE STAND WHICH WILL BE OCCUPIED, ALSO THE CHARACTER OF THE ACCESSORIES THAT WILL BE ON EXHIBITION

245—Gemmer Mfg. Co., Gears and Steering Components.
585—S. Hoffnung & Co., Ltd., Roller Chain.
255—H. W. Johns-Manville Company, Brake Linings, etc.
543a—The Lefever Arms Co., Transmissions.
529—Kein Starter Company, Automatic Starters.
525—Rupert C. King, Starters.
235—Link Belt Company, Belting.
282—The McCue Co., Axles.
501—Merchant & Evans Company, Clutches, Tire Cases, etc.
244—Muncie Gear Works, Gears and Components.
295—Newark Rivet Works, Rivets.
283—Parker Motor Co., Gasoline Motors.
252—The Royal Equipment Company, Brake Lining.
288—Russell Motor Axle Company, Axles.
617—Sheldon Axle Company, Axle Components.
308—Sparks-Withington Co., Controls, Axles and Transmissions.
169—Spicer Mfg. Company, Universal Joints.
543—Star Starter Company, Self-starter.
232—Thermoid Rubber Co., Belting and Brake Lining.
167—The Timken-Detroit Axle Company, Axles.
608—Tuttle Motor Company, Motors.
175—Warner Gear Company, Transmission, etc.
247—Warner Manufacturing Company, Transmission Gears.
123—The Whitney Manufacturing Company, Chains.

PAINTS, OILS AND VARNISHES

595—Harry A. Allers & Co., Solarine Polish.
415—International Metal Polish Company, Metal Polish.
554—John T. Stanley, Soaps.
183—Valentine & Co., Varnishes.
420—C. A. Willey Company, Paints and Varnishes.

RADIATORS AND OTHER COOLING DEVICES (INCLUDING SHEET METAL WORK)

597—The A-Z Company, Radiators, Hoods, etc.
186—Briscoe Manufacturing Company, Radiators and Mud Guards.
157—The Chandler Company, Name Plates.
577—El Arco Radiator Company, Radiators.
539—Fedders Manufacturing Co., Radiators.
533—Novelty Manufacturing Company, Radiators and Fenders.
607—The Harrison Radiator Company, Radiators.
250—Livingston Radiator and Manufacturing Company, Radiators.
325—McCord Manufacturing Company, Radiators.
283—Parker Motor Company, Gasoline Motors.
598—The Simonds Manufacturing Company, Sheet Metal.

SIGNALING DEVICES OF VARIOUS KINDS

618—Automobile Supply Manufacturing Company, Horns.
180—Gabriel Horn Manufacturing Company, Horns.
226—Lovell-MacConnell Manufacturing Company, Horns.
568—Nightingale Whistle Manufacturing Co., Horns, Signalers.
589—The Nonpareil Horn Manufacturing Company, Horns.
149—Randall-Faichney Company, Horns.
317—The Sireno Company, Electric Horns.
315—Troy Auto Specialties Company, Warning Signals.

SPEED AND DISTANCE RECORDING INSTRUMENTS

241—Auto Improvements Company, Speedometers and Taximeters.
254—The Columbia Speed Indicator Company, Speedometers.
588—Couch & Seeley Company, Casgrain Speedometers.
506—The Electric Speedometer and Dynamometer Mfg. Co., Speedometers.
236—The Hoffecker Company, Speedometers.
140—The Jones Speedometer Company, Speedometers.
286—Standard Thermometer Company, Thermometers and Speedometers.
619—Star Speedometer Company, Speedometers.
230—Stewart & Clark Mfg. Co., Speedometers.
172—Warner Instrument Co., Speedometers.
124—The Veeder Manufacturing Company, Speedometers.

SPRINGS AND SHOCK ABSORBERS

546—Ernst Flentje, Shock Absorbers.
156—Hartford Suspension Company, Shock Absorbers.
509—Kilgore Manufacturing Company, Shock Absorbers.
403—Penfield Shock Absorber Co., Shock Absorbers.
541—The Perfection Spring Company, Springs.
267—J. H. Sagar Company, Shock Absorbers.
240—The Turner Brass Works, Bumpers, Torches, etc.
609—Westen Manufacturing Company, Shock Absorbers.

STEEL, GRAY IRON, ALUMINUM, BRONZE AND BRASS CASTINGS.

187—Wm. Cramp & Sons Ship and Engine Bldg. Co., Bearing Metals and Castings of Manganese Bronze.
569—H. H. Franklin Manufacturing Company, Die Castings.
553—Gotham Aluminum Solder Co., Aluminum Solder.
503—Keystone Steel Casting Company, Steel Castings.
237—Lebanon Steel Casting Company, Steel Castings.
134—Light Manufacturing and Foundry Company, Castings.
287—Isaac G. Johnson & Co., Steel Castings.
279—Manufacturers Foundry Company, Castings.
426—Reinhold Noflux Aluminum Solder Company, Aluminum Solder.
614—The S. B. R. Specialty Company, Muffler Cut-Outs.
262—E. B. Van Wagner Manufacturing Co., Die Castings.

TOOL KITS AND OTHER MACHINISTS' DEVICES

582—C. M. B. Wrench Company, Wrenches.
155—Coes Wrench Company, Wrenches.
259—Cook's Standard Tool Company, Tools.
273—The Noera Manufacturing Company, Oil Cans, Tools, Pumps.
620—Valve Seating Tool Company, Tools.

UPHOLSTERY AND BODY TRIMMINGS

265—L. C. Chase Company, Artificial Leather.
613—L. J. Mutty Company, Leathers.
192—The Pantasote Company, Trimmings.
566—D. Reilly & Son, Leathers.

VULCANIZERS AND OTHER TIRE REPAIR EQUIPMENT

547—N. B. Arnold, Tire Paint.
557—Jas. L. Gibney & Brother, Vulcanizers, etc.
411—Hazen-Brown Company, Tire Repair Outfits.
502—Newmastic Tire Company, Tire Filling.
270—C. A. Shaler & Co., Vulcanizers.
602—Chas. O. Tingley & Co., C. O. T. Gum Gum.
421—Voorhees Rubber Mfg. Co., Tire Patches and Cements.

WHEELS, RIMS AND TIRES

222—Ajax Grieb Rubber Company, Tires.
623—The Allen Auto Specialties, Tire Accessories.
406—The Ashland Manufacturing Company, Jacks.
268—Auburn Auto Pump Company, Tire Pumps.
423—Automobile Tire Company, Tires.
278—Batavia Rubber Company, Tires.
106—Buckeye Manufacturing Company, Jacks.
404—Culver Stearns Manufacturing Company, Rubber Goods.
322—The Century Rubber Trading Company, Tires.
610—Clayton Air Compressor Works, Tire Inflators.
148—Consolidated Rubber Tire Company, Tires.
144—Continental Rubber Works, Tires.
128—The Diamond Rubber Company, Tires.
511—Dorian Remountable Rim Company, Demountable Rims.
580—Elite Manufacturing Company, Jacks.
231—Empire Tire Company, Tires.
526—Fegley Tire Chain Company, Non-Skid Chains.
164—The Firestone Tire and Rubber Company, Tires.
178—The Fisk Rubber Company, Tires.
272—The Gilbert Manufacturing Company, Tire Cases, Covers, etc.
127—The B. F. Goodrich Company, Tires.
122—The Goodyear Tire and Rubber Company, Tires.
131—G & J Tire Company, Tires.
125—The Hartford Rubber Works Company, Tires.
517—Hopewell Brothers, Tire Covers and Sundries.
323—Howard Demountable Rim Company, Demountable Rims.
136—Phineas Jones & Co., Wheels.
294—Kellogg Manufacturing Company, Tire Pumps.
275—Leather Tire Goods Company, Tires.
258—J. Ellwood Lee Company, Jelco Tires.
578—Meteor Gas Company of New York, Tires.
225—Michelin Tire Company, Tires.
249—Miller Rubber Company, Tires.
132—Morgan & Wright, Tires.
248—Motz Clincher Tire and Rubber Company, Tires.
284—Muncie Wheel Company, Wheels.
165—Oliver Manufacturing Company, Jacks.
537—Wm. E. Pratt Manufacturing Company, Jacks.
146—Pennsylvania Rubber Company, Tires.
151—Republic Rubber Company, Tires.
408—Rutherford Rubber Company, Tires.
611—Shawmut Tire Company, Tires.
292—Stevens Manufacturing Company, Tire Valves and Gauges.
251—The Star Rubber Company, Tires.
256—The Stein Double Cushion Tire Company, Tires.
520—Stevens & Co., Tire Valves and Gauges.
171—Swinehart Tire and Rubber Company, Tires.
579—Universal Rim Company, Demountable Rims.
414—Universal Tire Protector Company, Tire Protectors.
143—Weed Chain Tire Grip Co., Non-Skid Chains.

WINDSHIELDS, TOPS AND MOUNTINGS

538—Auto Windshield Company, Windshields.
416—Breda Automatic Fastener Company, Top Fittings.
625—Cox Brass Mfg. Co., Bumpers, Tire Irons and Windshields.
542—Detroit Motor Car Supply Company, Tops.
302—Hayes Manufacturing Company, Bodies and Tops.
522—Ideal Windshield Company, Windshields.
142—C. A. Mezger, Inc., Windshields.
621—Polson Manufacturing Company, Windshields.
415a—The J. Alexander Manufacturing Company, Windshields.
301—The Sprague Umbrella Company, Tops and Windshields.
548—The Troy Carriage Sun Shade Company, Windshields.
523—Vehicle Apron and Hood Company, Tops.

Show History

BRIEF OUTLINE OF THE EARLY EFFORTS AND PRESENT ACTIVITIES ALONG THIS LINE OF ASSOCIATIONS PROMINENT IN THE AUTOMOBILE WORLD

FIFTEEN years ago this Fall the first exhibition of automobiles in this country was made in New York City. It was a small affair, conducted in conjunction with a cycle show, and the general comment aroused was curious rather than interested.

In January, 1900, a show was given at which 35 vehicles were displayed. In 1901 the Automobile Club of America promoted what has now come to be known as the First Annual Automobile Show; it opened with much eclat November 3 and continued until November 10; there were 69 exhibits.

The Second Annual Automobile Show, which was likewise conducted under the auspices of the A. C. A., opened November 2, 1901, and continued until November 9. There were 92 exhibits of all sorts.

The following Fall no show was held, the dates selected for holding the third annual show being from January 17 to 24, 1903. There were 150 exhibitors.

The N. A. A. M. was a factor in the fourth annual show held from January 16 to 23, 1904, at which the list of exhibitors had swelled to 204. In 1905 James C. Young was named as manager of the show which was held from January 14 to 21. There were 252 exhibitors.

In 1906 the Association of Licensed Automobile Manufacturers entered the show field and executed a big coup by taking a lease of Madison Square Garden for several years, thus forcing the Automobile Club of America to seek elsewhere for a place in which to hold its show. The club and its associates selected the Sixty-ninth Regiment Armory and held its show as scheduled from January 13 to 20, the same dates used by the A. L. A. M. at Madison Square Garden. Both shows were larger than any that had preceded them, the licensed show having 50 car exhibits and 171 accessory displays, while at the armory 269 exhibits were shown.

It was shortly after this clashing of dates and interests that the American Motor Car Manufacturers' Association took an active part in the business of exhibition, and from December 1 to 8, 1906, this association, in conjunction with the A. C. A., held an exhibition in the Grand Central Palace. This show proved a big success, like all the others, and attracted 226 exhibitors. The licensed show was held from January 12 to 19, 1907, at the Garden. Sixty car exhibits formed its backbone.

In October, 1907, 24th to 31st, the eighth annual show, under the auspices of the A. C. A. and the A. M. C. M. A., was conducted at the Grand Central Palace.

In 1909 the A. M. C. M. A. held its show from January 1 to 7 and the A. L. A. M. followed from January 16 to 24.

In 1910 the Palace show was held from New Year's Eve until January 7 and the licensed show came along from January 8 to 16.

This season the first week in January will see a new show, or rather an old show under a new name, at the Palace. The A. M. C. M. A. having expired by limitation of time and leaving no inheritance of an organization, the independent show is being conducted by a newly formed body known as the American Motor Car Manufacturers' Exhibit Association.

The A. L. A. M. show will be held from January 7 to 20, being divided into two sections of a week each. The first is to be devoted to pleasure cars and the second week to commercial or freight vehicles, with the accessories showing during both weeks.

Thus in a single decade the display of automobiles has grown from informality and uncertainty to a station of importance that can hardly be exaggerated. Where at first the cars shown were mostly curious monsters of small utility as means of transportation and of almost prohibitive price, the cars displayed in recent shows represent the crystallized development of 10 years of the most effective work ever known in the history of mechanical growth.

Instead of ponderous and doubtful machines, like those exhibited in the early days of the trade, the modern automobile seems like an apotheosis or glorification of the motor car. Where they had weakness and treachery and mechanical uncertainty, the car of to-day has strength, reliability and certainty.

CAR EXHIBITS AT THE GARDEN

Booth No.	Exhibitor	Car
119	American Locomotive Co.	Alco
102	American Motor Car Co.	American
53	Simplex Motor Car Co.	Amplex
219	Atlas Motor Car Co.	Atlas
117	Autocar Company	Autocar
112	Brush Runabout Co.	Brush
106	Buckeye Mfg. Co.	Lambert
15	Buick Motor Co.	Buick
16	Cadillac Motor Car Co.	Cadillac
221	Cartercar Co.	Cartercar
212	J. I. Case Threshing Machine Co. (Pierce)	Case
206	Chadwick Engineering Co.	Chadwick
21	Chalmers Motor Co.	Chalmers
118	Columbia Motor Car Co.	Columbia
54	Corbin Motor Vehicle Corp.	Corbin
217	Courier Car Co.	Courier
50	Daimler Import Co.	Mercedes
5	Dayton Motor Car Co.	Stoddard-Dayton
8	Elmore Mfg. Co.	Elmore
23	E-M-F Co.	E-M-F
213	Flandrau Motor Car Co.	Brasier
4	H. H. Franklin Mfg. Co.	Franklin
120	The Garford Co.	Studebaker-Garford
114	Haynes Automobile Co.	Haynes
113	Hotchkiss Import Co.	Hotchkiss
11	Hudson Motor Car Co.	Hudson
205	Hupp Motor Car Co.	Hupmobile
201	Inter-State Automobile Co.	Inter-State
111	Jackson Automobile Co.	Jackson
204	Kissel Motor Car Co.	Kissel Kar
101	Knox Automobile Co.	Knox
10	Locomobile Co. of America.	Locomobile
7	Lozier Motor Co.	Lozier
209	W. H. McIntyre Co.	McIntyre
103	Matheson Motor Car Co.	Matheson
22	Maxwell-Briscoe Motor Co.	Maxwell
51	Mercer Automobile Co.	Mercer
116	Metzger Motor Car Co.	Everitt
215	Midland Motor Co.	Midland
12	Mitchell-Lewis Motor Co.	Mitchell
107	Moline Automobile Co.	Moline
52	Moon Motor Car Co.	Moon
104	National Motor Vehicle Co.	National
55	Nordyke & Marmon	Marmon
6	Oakland Motor Car Co.	Oakland
202	Ohio Motor Car Co.	Ohio
3	Olds Motor Works	Oldsmobile
14	Packard Motor Car Co.	Packard
203	Palmer-Singer Mfg. Co.	Palmer-Singer
19	Peerless Motor Car Co.	Peerless
20	Pierce-Arrow Motor Car Co.	Pierce-Arrow
110	The Pope Mfg. Co.	Pope-Hartford
108	Premier Motor Mfg. Co.	Premier
109	Pullman Motor Car Co.	Pullman
208	Regal Motor Car Co.	Regal
18	Reo Motor Car Co.	Reo
115	Royal Tourist Car Co.	Royal Tourist
105	Selden Motor Vehicle Co.	Selden
218	Simplex Automobile Co.	Simplex
207	Speedwell Motor Car Co.	Speedwell
1	F. B. Stearns Co.	Stearns
13	Stevens-Duryea Co.	Stevens-Duryea
2	E. R. Thomas Motor Co.	Thomas
17	Willys-Overland Co.	Overland
9	Winton Motor Car Co.	Winton

HOW to intelligently examine the new automobiles is the problem. At all events, in presenting the handiwork of the engineers and constructors of the various plants, it will be understood that every engineer is compelled to adhere to indicated lines as dictated by commercialisms, most of which are bounded by necessities, and, let it be said, to the end that the automobiles will be what the patrons want, at all events, what commercial captains think that users will express a preference for.

How to progress is one of the problems of the engineer, and, from the nature of the communications that come in the mail betimes, it is borne on the passing breeze, as an under-current of orderly discontent, telling of the shackles that bind, and how dominating ignorance takes "black-snake" in hand and lashes prudence, that child of good breeding and a university training, applying 30 lashes across the bared back. Disciplining the mind of the engineer and striping the back of prudence are not quite in the same category. When prudence winces under the lash, the blood that is drawn is wasted vital essence of the company whose captain applies the lash, but the very fact that he does so is proof of the fact that he is lacking in acumen.

Enthusiasm, buoyancy, a strong sense of responsibility, prudence which comes from the knowledge that "the divil will out" and all the other cautions and adaptations of skill, are properties of engineers, nor can a man be of this generic type for a single moment after he listens to a fallacy, even if it does promise a 66 per cent. dividend.

Placing the engineer in the functioning series of an automobile, there are many captains who would not hesitate to put him down as a most effective set of brakes. The captain of this class would say, "place my engineer in charge of the company and he would bring it to a full stop within the distance of its own length." Were this bold brigand of commerce told that he was bouncing along the road to ruin at the rate of 73 miles per hour, he would not be able to see it; could he, it stands to reason that the housetops would have to hold hands on ears to keep from having their ear-drums split; he would roar for the engineer; the brakes would then be none too good for him.

The good that is in the automobile and the industry that is responsible for it, crept in by degrees through painstaking effort on the part of those who held to high ideals, and the bad that is in it is there despite the very effort of this very class of men. Some money has been made by speculators, it is true, but it cannot be shown that this money has done the automobile business the least good. True, the man who enters the automobile business to make a pot of money will say, "What do I care for the automobile? What I am after is money."

Aspiring to be a bloated bondholder, the speculator creates a fictitious value for a time, and even if he does pull the cash out of the very business that he spoils to get it from, he is then, like a hulk of the sea, high and dry on the sands of disaster—the money cannot be invested by him in any safe enterprise for the reason that he destroys safety to get money, and he, with his

distorted views, would promptly destroy any enterprise that would take his money; instead of the enterprise absorbing his money, he would absorb the enterprise.

Why is it that a man who is regarded by the community in which he lives as intelligent will destroy an investment merely to pull a little cash out of it? Would it not be better to take the engineers' view of it and maintain the investment in a healthy state? Certainly 6 per cent. per annum from a plant that is valued at $100,000,000 is superior to the same amount of cash in hand. Supposing that the business be throttled for no better purpose than to get the cash; what is there to be gained? One minute after the plant is wrecked to get the money the man who thinks himself so fortunate is losing at the rate of $6,000,000 per annum.

The Engineer Stands for Safe Investments

Certainly, it takes a man of this stamp to put up the silly argument that the plant will not be destroyed. He will say: "I merely sell out; some other fellow will get the plant; it will run on just as before; I want the cash; it looks better to me than the plant; and, anyway, what is it to me? I got mine." What is the real situation? The industry suffers a loss; the transfer of greater value, the dividend of the brain, is taken out of the industry and is cast adrift, partly to purchase enjoyment in foreign lands and, for the rest, who knows?

Before a plant can be built up so that it will have a selling potential, the engineer must do much careful work; not so much, perhaps, as he would under poor management, but the most successful industry, even when the engineer is directed by a captain of intelligence and acumen, has many great problems of a technical nature to be solved ere it will be possible to claim success.

Where do the technicalities begin and end? Do they not arise with the building of the plant? Do they end at any time? If it takes a skilled engineer to lay out a plan, what assurance is there that any but skilled engineers will ever be able to direct the work through its divers ramifications to finality? When a doctor of medicine is called in and he pronounces the case one of typhoid fever, is he through? Will the patient's valet be thereafter called upon to direct the campaign and if he is, what will become of the patient?

Why is it that a captain of industry will go home when he is ill; crawl into bed; send for the doctor and obey his every wish? Is it because his conscience hurts him and he does not desire to face the hereafter without having an opportunity to show his engineer that he has sense enough to appreciate the fact that the doctor who cures him stands in the same light as the engineer who builds up his business despite the drawbacks of the type of salesman who does not consider the truth as worth telling.

What Is an Engineer—Do You Know?

Many poorly informed persons seem to labor under the impression that an engineer is a young man who has just completed four years at school, let us put it, a university, where he may have learned to play football, figure out the distance from the earth to the moon, tell his fond mamma how much he knows, and convince infants, by displaying a sheepskin, that he is capable of building a Brooklyn bridge, digging a Panama canal, or designing a Dreadnought. Even mamma knows better; wisdom, as it is, plays hide and seek around the fair brow of the mother of manhood, penetrates far into the future, and the eyes which do the seeing are too observing to be fooled by a sheepskin, especially if it makes too many claims, and is being caressed by youth. But the sheepskin is a certificate of the ideal of the holder; it is something for him to justify; living up to it keeps the boy so much engaged that he will have absolutely no time to commit depredations that he will afterward have to live down. In the course of time the boy falls or raises to his level; he floats in the eutectic by segregation, if he is of the mass and his level is reached. Being of the mass saves him from being an impurity.

Some men become designing engineers, others stand out as constructors, and quite a number of them find their places in the field of the executive engineer. Designing engineers are inclined to invention; constructing engineers are noted for care and precision, and executive engineers are pushers. Some engineers graduate from the hard school of experience, quite a few have experience and a university training, and the newer set came from the universities; they will ripen with experience. Executive engineers fill presidential chairs all over the land, and the automobile business is the better for a liberal sprinkling of them. When men change places with each other there is never any more cause for disagreement; the salesman who graduates from the engineering office is never afraid of the truth, and the man who migrates from the business office to the engineering department has breadth and scope.—P. G.

Views of Some of the Representative Engineers

One of the greatest difficulties we have is to get the purchasing agent to see the necessity of adhering to the engineering specifications. If a requisition is made for, let us say, acid open-hearth steel, it is extremely difficult to get the purchasing agent to see the difference between it and crucible steel of the same chemical composition, especially if the promise of physical properties is enlarged. The purchasing agent is more than likely to say: "I can get a better grade of steel for you at the same price." He does not know that he may be purchasing a class of trouble that will cost several times the price of the steel in machining difficulties; he is not in a position to know that "free cutting" is of quite as much importance as strength.

It is like going against God for some purchasing agents to adhere to the specifications for steel for use in automatic screw machine work; they do not understand that planishing to size, with a limit of tolerance of 0.005 inch, for instance, is of the greatest importance if the specifications so read; what does he know about automatic chucking and all the other considerations that go hand in hand with the process which eliminates workmen in the shop? Then, there is the purchasing agent, who, failing to move promptly in the first place, falls down on the drop forging purchases, and, rather than admit failure, contracts for manganese bronze duplicates at 38 cents per pound; quite an increase, let it be understood, but where is the purchasing agent when it is found that the automobile is costing too much? I would not be surprised to find him alongside of the president telling him what a dub that engineer is.

But the great crime comes in the purchase of hundreds of thousands of dollars' worth of lamps, horns, linoleum, tires, rims, and what not, long months before they are required. The vast sum of money thus tied up gets in the way of success. It might be said, of course, that it is necessary to assure delivery. It might also be said that it would be cheaper to tell the makers of these things that they must tote their own burden and failing to do so the engineering department might be consulted to see how the situation could be mended. There are occasions when it is the height of wisdom to make things rather than to buy them. This is not always true; the purchasing department should ascertain when it is. Buying too many limousine bodies; having to take, store, and pay for them, is one of the tricks of the purchasing agent. True, he may have the officials of the company at his back in this character of enterprise, but the fact remains that a schedule should be made and maintained so that the large cost involved will be minimized.—P. G. L.

Co-operation, Teaming, Good-Fellowship Needed

If an engineer is good at his business it will be to his interest to confine himself to it. Certainly it will not be good for him to try to pre-empt the functions of the management. That automobiles are now on a stable footing is true, but the man who thinks that they are in the throes of perfection is scarcely on a level to note the activities that are now going on in the engineering offices of the various progressive companies.

Team work is necessary; it is worth a whole lot to have confidence in the other partner; to know that he will hold up his end; to feel that he is a living, throbbing counterpart; ready and responsive. Good-fellowship is needed; why should we not be the best of friends? What's the good of harboring the feeling that the other fellow is not to be trusted?

I am not sure that the universities are doing all that they can accomplish. Sometimes I am led to believe that the products of these establishments are too stuck up. The man who desires to get the best there is in a grease-besmeared mechanic will have to put a little grease on his own visage; it savors of grimness; the life of a mechanic is grim; misery loves company.

Let us be friends. Why not pull together? When the man who is entrusted with the making and marketing of a device such as an automobile, what he needs is the best activities of the engineer, the purchasing agent, the mechanical man, and the office boy—all; each living individual; they must beat time, lock step, and "play ball."—G. W. R.

Too Superficial—Let Us Get Down to Brass Tacks

Is it not strange that ten years went by before it was discovered that all the talk about 30,000 volts more or less being used in the fire of the charge in the combustion chambers of the motors that are doing such good work every day in the year is all rot? Actual investigation will be more likely to prove that the average spark plug will not stand up under a voltage of more than 10 per cent. of the vaunted 30,000. It is fortunate if the voltage does not have to be so high; such high stresses are difficult to hold; the fact remains that the difference came as a great surprise to those who are supposed to know all about it.

Let us get down to brass tacks hereafter. Why should we go on for years taking the word of salesmen, or eking out a precarious knowledge from the literature which comes from advertising agencies; what do they know about it? Where would they learn? Who would care to impart to them the information that they would use against the very company that might be responsible for their training? What possible good is there in saying that we are engineers if we do not know, as a matter of personal information, all that we should know about the very matters which are entrusted to our care?

Take the metallurgical art; what do we know about it? Let me tell you. We are mostly full of the information that steelmakers hand out. Did anyone ever hear of a steel-maker imparting any information that would hurt him? Is he likely to hurt his pocket book? Why should we not get down to business in this important matter? Those of us who have a laboratory training know full well that the steel situation has a kink in it that should be straightened out; let us take hold of this branch of automobile building with the same care that we expect our wives and sisters to exercise when they go to the grocer for a pound of butter; it is a great misfortune that poor steel does not smell.—B. F. A.

Thermal Questions Have to Be Disposed Of

Motors, taking the present types, do very well, let it be taken for granted. Are they perfect? Far from it. Is the thermal efficiency as high as it ought to be? Probably it is as a laboratory proposition; that is to say, in the laboratory the realization of over 20 per cent. thermal efficiency is a very fine performance. When the motors are put into automobiles, instead of a thermal efficiency of 20 per cent., what do we realize? Are we sure of 14 per cent.? Not quite.

What is it that creeps in between the motor and success when it is placed in a chassis and put out into commercial work? May we not conclude that it is a mass of unknown quantities that get in the way? What is the nature of the fuel that is being purchased by automobilists? Do they know? Do we know? Who knows?

If we build a carbureter for use with a given grade of liquid fuel, say hexane, and this fuel is not to be had on the market as a regular thing, what is the good? If there is a fuel necessity and we disregard it, where are we at? If failure camps on our doorstep and it is a messenger from the fellow who concocts the fuel job, are we not poor engineers if we do not boot the messenger out of our yard and send him back home?

But why should we build carbureters to handle hexane if it is not the regular fuel of commerce? Do we wish to be classed with men who hook their aspirations to the remotest star? Is it not necessary for us to find out what is the character of the fuel that we have to use, and then make our motors so that they will thrive on it? We have been so engrossed with our work for a number of years that we have failed to keep track of some of the really important details. It would seem to be a good idea to go after the details with a vim and a vigor that will land them in the classification of solved problems.

Valve Questions Occupy Center of Stage

For some time to come it is believed that automobile engineers will be engaged in valve work. The Knight motor and its success abroad has caused a lot of deep thinking. Makers of automobiles, who desire to keep abreast of the times, are not slow to recognize the fact that there is more than the mere question of merit to be considered. If the Knight motor works fairly well, and it comes over here in foreign makes of automobiles, there will be an invasion that will not be kept out by a mere tariff wall. One of the good characteristics of the American may be summed up when it is said that he will go after, and get, what he desires, and if he puts in a brief for a Knight motor he will have it by the very next steamer.

That there is a good chance for a number of marked failures in this quest for a substitute for the poppet valve is proven by the failures that already show up on both sides of the trail. Poppet valves, if they are properly designed, are not to be sneezed at. The trouble is, designers do not compare notes with each other; they are not in a position to take advantage of co-operation, but the Knight motor, and the scheme that is being worked abroad, is on a basis of co-operation. The British Daimler project is being supervised by Charles Y. Knight. Then, the Panhard (Knight) motor, in France, has all the benefit of Daimler experience. Cross to Belgium; what is the result of observation? The Minerva (Knight) undertaking is getting the benefit of the Knight experience in England. Likewise in Germany the Mercedes (Knight) work is under the light of cooperation, and so on in Austria, and in Italy.

But how about America? What are the measures for cooperation here? There are none. We are so much engrossed in our efforts to best each other that we have no time to compare notes? In the meantime, are we getting along? Are we as successful as our efforts would lead us to believe that we ought to be? The strange way that we have for proving the strength of our brotherly love is taken advantage of abroad and the result is that we read in the technical papers of the divers ways that others employ to combine knowledge and cash it in over our heads.—P. J. M.

Hardness Is an Important Property of Materials

Each metal as an element has certain characteristic virtues as well as shortcomings. Platinum, now the rarest commercial metal, would perhaps not be bothered about much if it were not for its remarkable refractory power to resist heat, oxidation and acids; its coefficient of expansion also, unlike any other metal, is the same as glass, so that it alone can be fused into this material without danger of cracking under temperature changes. Under the hammer platinum increases from the cast hardness of 10 to about 17 per cent. that of hardened steel without losing its remarkable ductility.

As a constructing metal, it cannot be hardened by alloying, however, without destroying its other natural virtues and therefore its usefulness must remain within the limits of its low hardness.

Gold and silver resist corrosion very well and are beautiful, so that they are very valuable for some purposes, but for general utility their hardness is far too low.

Copper resists corrosion less than gold or silver and much more than iron, but since its hardness is but 6 per cent. that of hardened steel it would be, like gold, of very little use to the arts if it were used pure. By alloying tin with pure copper, a hardness of fully 40 per cent. that of hard steel is obtained in the casting so that an alloy of vast commercial importance results.

Iron (when pure about 16 hard) is the hardest of the ductile metals, and it is most wonderful in that it is sensitive to magnetism, unlike other metal in this regard. Iron is the strongest metal, but then, as if to counterbalance this, it has a pitiful weakness, for it corrodes.

Iron has affinity for carbon, producing hence the alloy we call steel. All that carbon is put in iron for is to harden it and no matter how hard it is ever vulnerable to corrosive influences.

Much nickel in steel improves its resistance to corrosion, but, however, entirely at the expense of its hardness. Some of the soft metals are valuable as carriers of electric current and heat because of their high conductivity, but iron and steel are high resisting mediums. Hardness ordinarily cannot be imparted to a metal by alloying unless at a sacrifice of other virtues, and one of the first thus to suffer is ductility. Steel retains ductility longest, although it was only recently through correct alloying and careful smelting that a certain amount of ductility could be retained at a very high hardness when heat treated—high enough, in fact, to be suitable for many tools and automobile parts of 80 to 90 hard.

It is now a well-known fact that the strength of all metals having some ductility increases rapidly with that of the hardness. A steel which shows a slight permanent set before fracture under tensile stress when 85 hard will resist something like 250,000 pounds per square inch without suffering permanent deformation.

Resistance to shear as in rivets, screws, etc., increases also with the hardness, so that now great care is taken to have them of the proper hardness in important structures and machines. Resistance to wear and also the cutting power of tools is so directly dependent on the hardness that these properties are known as soon as the hardness has been measured.—A. F. Shore.

The Worm Drive Question

The application of the worm drive to automobiles, while it has been used quite extensively and in a large measure satisfactorily on cars of foreign manufacture, has only recently become the subject of serious consideration in this country. That many of the larger producers are at the present time experimenting on this method of drive there can be no doubt, but how far advanced they have become in the art is largely a matter of conjecture, as their experimental work has been closely guarded from the public eye.

Among the English manufacturers probably more than in any other foreign country the worm drive has for a number of years been an accepted factor in the automobile industry, and, coupled with the further significant fact that its use in that country is rapidly on the increase, would seem to prove its worth.

From a theoretical standpoint and accepting empirical formulas as closely indicative of the true operating conditions, it appears that the efficiency of a properly designed worm and wheel is high, probably between 90 and 95 per cent., and it is likewise true that it increases appreciably with a reasonable amount of wear.

As much cannot be said of the average bevel gear. Under purely theoretical conditions and with teeth properly generated, the contact of bevels should be rolling. This condition in actual practice is seldom, if ever, even closely approached, and the heat treatment necessary to produce a gear and pinion of necessary toughness and surface hardness makes still more difficult the attainment of this ideal condition. Tooth friction and consequent wear are the inevitable results, and, although reasonably quiet in operation at the outset, a pair of bevels will gradually develop noise.

The worm and wheel, on the other hand, transmit power purely by sliding contact, which in all cases and under all conditions develops a certain amount of friction. This friction, however, will not increase with wear, but, on the other hand, tends to diminish as the tooth surfaces approach a glass smoothness. This would seem to indicate that noise of operation should decrease with wear and seems to substantiate the contention, which the worm drive advocates advance, that the efficiency increases.

The construction, as applied to a car with propeller shaft drive, in which the worm is placed over or under the worm wheel, which carries as an integral part of itself the difference, is generally accepted.

Those using the under drive contend that, the entire driving surface being immersed in oil, a more perfect lubrication and cooling effect is maintained. Undoubtedly this is true, but at the same time, unless rather large road wheels are used, in order to secure sufficient flywheel clearance, it becomes necessary to give the propeller shaft a decided angle or to incline the motor and transmission in the frame. With the overhead drive these conditions are eliminated, but the center of gravity is very materially raised, it becoming necessary in some cases to incline the propeller shaft upward toward the rear axle.

The worm drive is one of the points of motor car construction on which much instructive experimental work has yet to be done, and it is safe to prophesy that within the ensuing year several American-made cars will be advertising this line.

W. M. Hogle.

Methods of Auto Control

Having been asked by the editor to contribute my views on this subject, I can do that only from the standpoint of a car user and operator.

There is a crying need for the standardization of control elements. It is a decided nuisance to drive for a time one car, then change over to another and find that all of the movements, whether the hand lever or foot levers or of the spark and throttle control, are different. No driver can be said to have his car under proper control unless every movement that he makes, whether to change his gears to advance or retard his spark, to give more gas, to operate his brakes, to throw his clutch in or out, is instinctive. An instinctive control, however, is absolutely impossible, on two different cars having different

handling arrangements. The passenger who entrusts himself to a driver who is handling a car other than the one he has been used to incurs a serious risk.

Automobile designing engineers are possessed of a high order of talent; there can be no question that each has very good engineering reasons for his particular arrangement of control; nevertheless, the ultimate result is one of intolerable confusion and, worse than that, of serious risk.

The ideal arrangement of control will probably never be found. The best arrangement of control, however, is one that is not difficult to conceive. It is by no means necessarily the ideal arrangement, but it is the one that would be alike for all cars. Take the gate, for instance. There is no good reason why forward position inside should be direct drive on one car, while on another car direct drive should be the rear position outside; there may be some structural reason of advantage for each position chosen; no such reason, however, can compare in weight with the disadvantage of dissimilarity of control and with the risk of damage impending when the same driver is called upon to drive two cars having these differences.

Again, there may in each case be some good structural reason for placing the foot accelerator between the clutch and footbrake lever on one car and placing it outside of the footbrake lever on another car. The passenger in a car who has been seriously injured as a result of a wreck due to a driver who has instinctively shifted from the accelerator to the right to reach the footbrake instead of in the reverse direction that a new, unfamiliar car demanded finds small consolation, if any, in the fact that either arrangement possessed certain structural advantages from the car builder's point of view.

If there were in existence a body of users of sufficient influence to impose due consideration of its interests on the builders of cars there can be little question but that it would absolutely demand uniform and standard design in the entire controlling mechanism, so far as the position of parts and movement of those parts by the driver was concerned. No greater service can be done to owner, passenger or driver of cars than the bringing about of this standardization, and no greater service can be done the builders of cars, since the ultimate best interest of the builder of the car is absolutely that of a driver, owner and passenger.

Two Ball Bearing Crankshaft

The editor has asked me to contribute my views on the subject of two ball bearing crankshafts.

This can be regarded from two viewpoints: One, the suitability of the ball bearing for crankshaft work; secondly, the crankshaft supported on only two bearings.

There is, has been and probably always will be much difference of opinion as to the advisability of using ball bearings on crankshafts. Some of this difference of opinion is based on doubts of the ball bearing being suitable for work of this character—that is, being sufficiently durable. As ball bearings are in daily use, carrying loads that are hundreds of times greater than those ruling in crankshafts, it is clear that the question is answered in the affirmative, from a standpoint of the durability of the ball bearing to carry the load. The question then narrows itself down to a ball bearing of dimensions such as a designer would consider practicable in a crankshaft case. The best answer here is that of experience, and that again is in the affirmative. At the present moment there are at least sixteen car builders who are using ball bearings on their automobile motors regularly and who have turned out many thousands of such motors; in a number of instances their use goes back five or more years. A significant feature also is that those among the builders who have the longest experience are the most enthusiastic and definite adherents of the ball bearing for the crankshaft. That there has been an occasional case where a ball bearing has not been satisfactory on a motor is true. Invariably that has been found to be due to one of three factors, either the employment of ball bearings of relatively poor grade, or the employment of a ball bearing of insufficient size, or incorrect mounting. The ball bearing possesses no magical properties which will give good results for lack of intelligence. In favor of the ball bearing, it may be said that it will stand abuse and put up with improper usage. It is very certain that a short stoppage in the oil supply will not affect the ball bearing, whereas a similar trouble will result in a melted plain bearing and considerable secondary trouble and expense, although this is no reason for desiring to run ball bearings without oil.

As to the two bearing crankshaft, whether of the ball bearing or plain bearing variety, that is a matter of suitable design of crankshaft; such shaft must in itself be stiffer than one supported on more bearings, since the distance from the point of application of load to a bearing is greater where only two bearings are used. On the other hand, a two bearing arrangement possesses the advantage of greater simplicity, of a lessened number of parts and of great immunity from the results of flexure. If the two bearings are ball bearings, then still greater deflection without harmful results will be possible, because the ball bearing is very much shorter than the plain bearing. If this deflection be kept within 6/10 of 1 degree, then there will be no trouble with the ball bearing, provided, always, of course, that a bearing of proper size has been selected and that that has been properly mounted.

As a designer and manufacturer of ball bearings, it has been my practice to deprecate the use of a ball bearing for every place for which it is not properly suited, or where it would not give better results than would the plain bearing. The field of the ball bearing is so large that it would be very poor policy to court trouble and consequent loss of reputation by advocating ball bearings for unsuitable places. It is quite true also that there are very few places indeed where the ball bearing does not absolutely justify itself from an engineering standpoint. The determining factor is chiefly an economic one, since there are certain classes of machines that are of so low a first cost and that operate sufficiently well on the cheapest type of plain bearings that the increased cost of ball bearings is not justified. The particular machine element here under discussion—that is, the ball bearing crankshaft—however, does not fall within this category.

The best people to secure testimony from regarding the ball bearing crankshaft, whether of the two bearing or multiple bearing variety, are the manufacturers of cars that are now and have been for a considerable time employing them. Testimony from the users of such cars, particularly from those who have had their cars for a number of years, would prove of decided value in corroboration. HENRY HESS.

Efficiency Ruling Consideration

To-day the universal demand is for high efficiency. Machines are bought, used for a little while and discarded, not because they are worn out, but because more efficient machines can be secured to take their places. This continuous substitution of the new for the slightly old is made in the interests of economy. It is, however, not usually left for the manufacturer to decide, unaided, that a new machine is needed, for there are many, and clever, machinery salesmen who are "missionaries of efficiency," as it were, to keep the merits of new machines constantly in the limelight. These men, and the factories back of them, are willing to guarantee results, and, with the whole business world to-day, results count.

It is unfortunate that men and methods are not so easily to

be compared as are machine tools. The automobile business, on account of its very newness, has had the advantage of machine tools of advanced design, but in many cases, also on account of the youth of the companies, or on account of some fault of mind in the management, real organization has been sadly lacking. And lack of organization means low efficiency. Management has been defined as "knowing exactly what you want men to do, and then seeing that they do it in the best and cheapest way." Naturally men must first be selected that are competent, and then they must be so managed as to produce maximum results. Any high-grade man really desires to do the best that he possibly can, for he realizes that efforts less than maximum will cause him to lose his self-respect and will stunt his further growth and advancement. The general manager is indeed wise who gives every man a chance to do his best. Strange as it may seem, there are many men in managerial positions who apparently will not do so, but who try to run things after the fashion of a martinet, so that all of their subordinates may be impressed with their supremacy. The ability to manage can be measured by the enthusiasm of the worker.

The automobile business is at the present time passing into a new stage of development. This statement hardly holds true for every automobile company, for some of them are now on a proper manufacturing basis. More are not. The day of the trained production engineer is almost here, while the day of the "rule of thumb" type of superintendent is rapidly passing. To-day, in supposedly modern automobile shops, it is possible to see gross violations of the primary principles of production.

The fact is historical that if a man is to do his best work he must be physically comfortable. It is possible to see in factories so recently constructed as to be of reinforced concrete no provision made for ventilation other than the leakage of air around the windows. It is possible to see men working in the exhaust fumes of motors day after day and each evening complaining of headaches. Yet it is almost impossible to see why any management is so stupid as not to realize the relationship between good health and maximum production. Not only do managements bind themselves to many of the conditions that really have a marked effect on output, but they fortify their blindness by an implicit and childlike confidence in some "system" that has been installed. The story is told of an employer who ran a shop in which machine sewing was done. In the summer the output began to decrease, and continued to do so in spite of some premium plan that rewarded extra effort. One day the manager, strange as it may seem, noticed how warm it was in the workroom. He brought out his office fan and arranged it to cool the workers at one table. The output at once came up to normal, or went above. Fans to keep the workers cool completely cured the underproduction trouble.

In those factories where physical conditions have been made right the next step is to increase production through the use of some of the well-known plans for operating on a truly economical basis. It has been recently reported that the production of the Renault Co., in Paris, has been doubled through the use of the scientific efficiency methods largely developed by F. W. Taylor, who put many of his plans into operation at the Bethlehem Steel Co. some ten years ago. The results described by Mr. Taylor in a paper read before the American Society of Mechanical Engineers, and appearing in the Transactions of the Society for 1903, certainly give food for thought. One definite example of the success of these scientific efficiency methods relates to work done by laborers. In the handling of rough materials the average cost per ton was reduced from 7.2 to 3.3 cents, while the average tons handled per man per day rose from 16 to 57. Under the new method the average earnings per man per day rose from $1.15 to $1.88, and all of the lazy or incompetent men were weeded from the force. It was a case of the survival of the fittest, with a suitable reward for having really done a day's work in a day.

Without question the automobile business has been built up by bright and daring men. The very troubles and difficulties of the automobile industry attracted them. They have had their problems to solve, and have solved them with scant respect for traditions. Facing heavy odds, they have made a business. It must next be their care to economically operate and conserve the vast industry they have created.—M.

It stands to reason that worthy ideas should not be disregarded simply because they are out of season; the world has never missed a season yet.

Graves for Gold

WHEN MONEY IS ACQUIRED IT STILL REMAINS FOR THE HOLDER TO SPEND IT WITH A DISPLAY OF INTELLIGENCE—GRAVES YAWN ALL AROUND

GETTING money honestly and spending it intelligently is just as much a problem for the man who owns an automobile as it is for the man who would like to own one. There is one thing certain, and that is, the unfortunate who acquires any considerable amount of money honestly will not have to bother with a "coach" to initiate him in the intricacies of approaching the Golden Portal and wheedling the Worthy Grand Warden into articulating the welcome words, "Enter." Having accumulated a surplus of money, then the real problem begins; how to get rid of it intelligently remains.

There are more graves for gold than there is gold to fill them—hence the scarcity; but this has its fortunate side; gold would not be valuable were it not so good a filler for the very yawning chasms to which allusion is made. It is not like weeds in a garden; they are not regarded as valuable because there are enough to go around, and some to spare. On the other hand, when a single weed was exhibited in the Paris exhibition, believing it to be some rare flower, all the good people, and the savants of the world, bowed down and worshipped.

The real reason why, then, that it is a good occupation to go in quest of money is because it is so scarce; the same reason holds for the spending of it. Perhaps it is not too much to say that going after money honestly is also a good practice, due to the fact that honesty is so rare. At all events, having acquired a surplus of money, the necessity of spending more time on the trail of the elusive dollar is not apparent, but it does demand the display of a little ingenuity holding on to that which has been acquired for the very reason that it is "exclusive" and hunters abound at every point, ready to welcome the transfer of the money from its insecure resting place to a more promising fireside.

Automobilists are justified in the complaint which they continually make; how to locate the graves, of which the automobile holds a few, and so close up the entrances of them that they will

bar out useless expenditure is a problem. The first thing to do is to locate the graves; then realize that they are there; after which it should not be so difficult to keep them from absorbing so much money.

Who is to blame for the presence of these graves? Who, to be sure? The state of the art, of course! When we learn more, we will know more; when we know more, we will accomplish more.

In the meantime, to the automobilist who wants to get wider service out of his car for the expenditure and reduce the size of the gold-grave that pesters him there remains the expedient of being intelligent about it. Are all automobilists intelligent, that is to say, do they display the fullest measure of intelligence in the management and use of their equipment? Let us see.

Take the man who runs his car faster than is necessary; does he display intelligence? Does he take into account the fact that a car will last just four times as long if it is driven at half the four-time speed?

Let us comment upon the intelligence of the automobilist who thinks that he is immune from repair bills because he pays $5,000 instead of $1,000 for his car; his first act is to hand out $4,000 more than the cost of the lower-priced car; quite a large repair bill considering it in this light. But he is a more fastidious man; he wants class; he gets it. Now, having paid for class, so-called, why should this buyer reach the conclusion that he escaped a repair bill? Has he not really added to his responsibility? If the rate of depreciation is 10 per cent., and it is at least that, the man who pays $5,000 for an automobile faces a $500 depreciation account the first year. The fellow who pays $1,000 for his car faces a $100 depreciation account the first year.

If the rate of depreciation is more than 10 per cent., both owners are confronted with a larger depreciation account the first year. What about the second and third years? They will not be less costly than the first year, but the story is along other lines. The fellow with the $5,000 automobile will say, "My automobile will not depreciate as fast as will the $1,000 car." How passing strange it is that graves are so difficult to locate! It is like gunning for cats in the jungle.

In all truth there is no more reason for a $1,000 automobile depreciating than there is for depreciation of a $5,000 car. If the low-priced car is not so well made it is protected from the hard work that the higher-priced car will have to do and the one balances the other. The Firth of Forth bridge is a marvelous piece of bridge engineering; it challenges the admiration of the world; as a "class" undertaking it ranks with the $5,000 automobile. Will the Firth of Forth bridge outlast some little $1,000 stone culvert that anyone can find along the roadway by riding a few miles? Better yet. Is it not a greater risk? Is it not true of everything that the risk is in proportion to the cost?

When a man buys class in an automobile, one of the properties that he expects to find in it is speed. It is this speed that is the largest grave for gold. It is the difference in speed between the high and the low-priced automobiles that makes the low-priced car just as safe a risk from the depreciation point of view as is the high-priced car.

Now, the man who wants speed and class is justified in purchasing the kind of an automobile that holds these properties. His mistake, if he makes one, lies in the bald assumption that he has purchased the right to shun repair shops for evermore. The chronometer that a horse admirer carries around in his vest pocket, however accurate and well made it is, will only run for a certain length of time before it must be laid upon the table of the repair man and the cost of the repair will approximate $15, unless it is true that the repair has been delayed too long—an ordinary watch may have to be repaired a little oftener, but the cost of doing the work is perhaps $3. It is not certain that the cheaper watch will have to go to the repair shop more frequently than its aristocratic cousin. Everything goes to show that when a man purchases style, and pays for it, he is getting his money's worth if the thing that he wants is actually present in the delivered article, although it is not possible to conceive of real style if the structure is poor and the appearance is a mere bluff.

The greatest gold-grave, so-called, is the automobile that is an imitation of a high-powered, stylish automobile without the good workmanship that must be present with good materials in order to withstand the torquing of a powerful motor. If speed makes inroads in the sweet-running qualities of a well-made automobile, it is not too much to expect that it will make an ill-appearing mess of the mere imitation.

There is one other point; a little noise, if it emanates from the bowels of a low-priced automobile after a year or two of real service, is not so much of a crime as it will be if the same noise comes from the clanking of parts of a high-priced car. Then, the nerves of the owner are keyed up in proportion to the price he pays for his automobile. A man does not of necessity indicate that he is unreasonable if he objects to noise in a high-priced car; it is the noise that he desires to avoid, and he indicates that fact when the high-priced selection is made.

But there is this to be said about every man: if he gets what he sees in his mind's eye he is quite content; it is not then a question of the cost. The trouble creeps in when the mind's eye is near-sighted. Now, there are spectacles for the normal eye and they help the wearer to see things as thy are; but when it comes to the mind's eye, instead of magnifying glasses, what is needed is intelligence; that character of intelligence which comes from contact, study, observation, and the resultant experience. The mind's eye of the purchaser of the high-priced automobile is frequently near-sighted; it is up to him to learn that there is a reason why an artisan selects a Queen Anne cottage for an abode, leaving it for the fellow with more of an income to "reside."

Just to uncover one more grave for gold and the grewsome task will be set down for a continuance at some future term of the digger. The man who selects a low-priced automobile does so to satisfy a broad situation. It is a reasonable assumption that money is too scarce for him to undertake to support a high-priced car. This is not an indication of the presence of superior lasting qualities in the more pretentious automobile. It is likely to indicate that the purchaser is compromising with his pride in proportion as he is catering to his prudence. But the very sign of prudence at the wheel is an indication of life in the automobile.

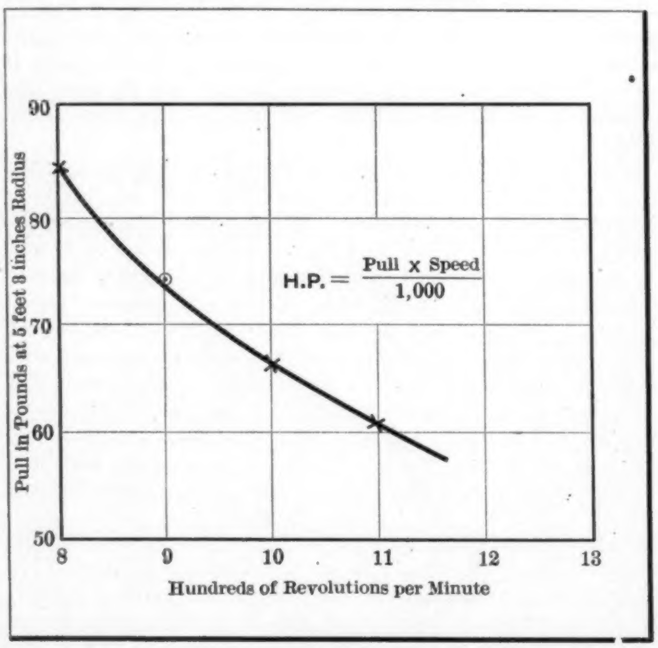
Prudence is the greatest driver in the world. The car will last longer, go farther, and perform more silently in the hands of the graceful little elf than it will otherwise. It is Prudence who knows just how to cover up the gold-graves that hover around the automobile. Prudence, with the deftness of a graceling, clad in gossamer web, flits about with an oil-can, putting a drop of the magic fluid here and there in the little crevices, wiping off the excesses with her silken sleeve, and with a sharpened stick from the tree of wisdom this pretty child of the imagination pokes in the orifices, clearing them of accumulations before the oil is allowed to make mud-pies; for indigestion, however enjoyable it is for a man, is not good for an automobile, and Prudence knows that mud-pies will lead directly to a grave for gold through a labyrinth of automobile indigestion.

Prudence stands high in her class in the schoolroom; if there are three Graces, surely she is not the least among them. The old grave-digger chap, with all his cunning, looks with a despairing eye at the saucy little beggar, and, strange to relate, she of the gossamer web and the large inquiring eyes is passionately fond of the automobilist of small means, and the low-priced automobile.

Flexibility of Motors

THE HORSEPOWER RATING OF A MOTOR SHOULD NOT BE CONSIDERED AS OF FIRST IMPORTANCE—FLEXIBILITY MUST HAVE A PROMINENT PLACE IN THE FINAL SUM-UP

RATING an internal combustion motor such as is used in automobile work is a simple matter for popular consumption, but coming down to realities the pathway is beset with difficulties. If horsepower alone is taken in the rating of a motor, it may be that the power claimed for a given motor will be at some speed that cannot be utilized in practice. As an illustration, let us assume that a 4 x 4 inch bore and stroke motor may be so designed that it will deliver 25.6 horsepower at a piston speed of 1,000 feet per minute. Now, this piston speed means that the motor speed will be 1,515+ revolutions per minute. In order, however, to be able to utilize the motor at this speed, if the transmission gear is so designed that the drive will be direct on high gear, the bevel-gear set will have to be in the ratio of $1,515 \div 374 = 4.05+$. This is a possibility in practice; it is about the limit under present conditions of construction unless resort is had to worm drives; they are now used to quite some extent abroad; the reason is obvious. But supposing the same motor to be rated at 38.2 horsepower, and to obtain this power it is necessary to so design the motor that it will speed up to 2,572 revolutions per minute in the delivery of this power. The bevel-gear set would then have to be designed on the basis of a little over 6 to 1. What does this mean structurally? Supposing that the bevel pinion be given 15 teeth, 5 diametral pitch; for a ratio of 6 to 1 it would be necessary to put 90 teeth in the gear. Such a gear would have a pitch diameter of 18 inches. It will be unnecessary to continue this part of the discussion; there is no room in a live rear axle housing for a gear of such large dimensions. But if the gear cannot be used, it also happens that the motor cannot be employed at the power of its rating. This being true, the motor might just as well live under a more modest name; it becomes a 25.6 horsepower motor instead of a 38.2 horsepower motor to all intents and purposes.



Torque curve of a motor showing how the twisting moment varies with the speed of the motor, indicating that it is necessary to consider the characteristic of the motor when the gear-ratio is being settled upon

It does not necessarily follow that all motors of this size can be expected to deliver 38.2 horsepower at 2,572 revolutions per minute, any more than it is true that the power will be up to 25.4 horsepower at 1,515 revolutions per minute. Just what a motor will do in the matter of the delivery of power is a question that must be settled by running a test of it to find out. In the same way, if the flexibility of the motor is to be determined, it is not only necessary to make a test, but it is also essential to plot a curve as shown in the illustration and after a study of it the flexibility of the motor will be up for consideration.

High-Speed Characteristic May Be a Drawback

If the designer of a motor does not consider the automobile in which it is to be harnessed, he may spoil the motor in so far as its performance is concerned. The flexibility of the motor may be destroyed when it is harnessed in a chassis that will not allow it to perform under conditions that would be advantageous to it. Take the motor as above cited at the higher speed given; if the gear ratio is 4 to 1 instead of 6 to 1, the motor will have to work at 2-3 of its best power speed. Will the motor then deliver 2-3 of its maximum power? Who would care to hazard the guess? But if the motor will not deliver 2-3 of its power at 2-3 of its speed, what chance is there of obtaining a good performance at the lower range of speeds under which the motor will be required to work in an automobile?

Obviously, a good motor, very good perhaps, will deliver poor service under such conditions. When an automobilist of a little experience goes to a salesroom and tells the agent that he will take the car (some automobile that attracts his discriminating notice) if the gear ratio is changed to suit notions that he preconceives, what chance is there of the automobile ever being as good as it should be? What will the agent do? Will he "accommodate" the customer who has the temerity to usurp the designer's functions—the designer of this part'cular automobile? Is it not a simple usurpation of the functions of the designer? When a customer comes along and assumes this prerogative, is it not natural that the agent should also assume that the customer knows what he is talking about? If so, is it not all right to take the purchaser at his word and let him have what he is willing to pay for? He will go away vexed if he is thwarted!

It would serve the purchaser right to do this, but there is a good reason why it is not desirable to comply with the request. No maker of automobiles can afford to have his name-plates on cars that will be a discredit to the name. The purchaser will forget that he dictated the change; he will only remember that he paid for a good automobile, and, in so far as he can tell, it will not be a good automobile. The purchaser will do untold damage to the maker; he will tell all of his friends that he was "stung." It would be true, but it is equally a fact that this class of purchaser is so self-contained that he goes around with stinging equipment for his own consumption.

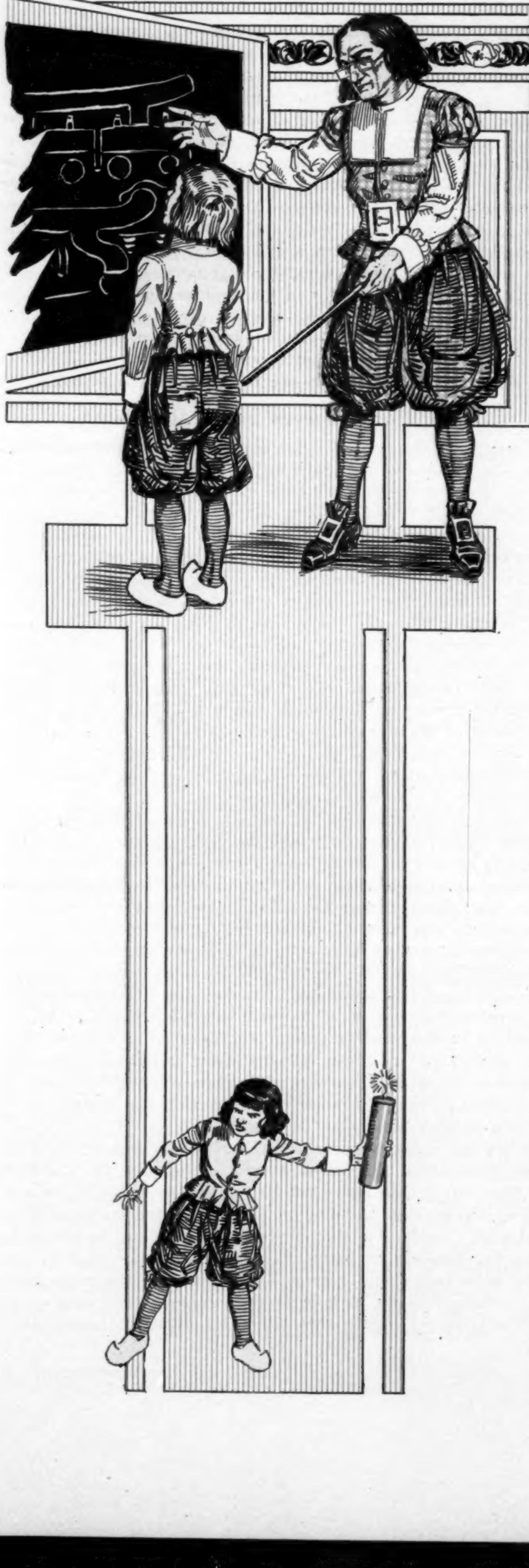
It Stands to Reason—

That it is a piker's strong play to get quick action.

That the man who acts quickly in the matter of taking free advice has plenty of time to repent—the leisure is all his.

That money will keep; deliberation is the perquisite of the "prospective" who purchases the best automobile for him.

MOTORS



DELIVERY of power from an internal combustion motor comes from lighting a hot fire in the combustion chamber, burning the fuel to complete combustion, and accomplishing the task so quickly that a new fire is lighted every tenth part of a second. Nor is this the limit of speed; ten fires per second means:

$10 \times 60 \times 2 = 1{,}200$ revolutions per minute of the crankshaft of the motor, which is about half of the possible speed of attainment under working conditions in some motors, it being true that there are two revolutions of the crankshaft of the motor per fire in four-cycle work—that is, when the motor is designed to work on the four-stroke cycle principle, in other words, when there is an explosion, so called, after inspiration and compression to be followed by a scavenging stroke, making the cyclic relation (a) suction, (b) compression, (c) power and (d) scavenging. This makes one cycle per stroke, and there are two strokes per revolution, so that it takes two revolutions of the crankshaft to afford the four cycles.

To the average motorist this cyclic relation in a motor is Greek. For a better understanding of what it means to kindle a fire in a tenth part of a second, let the reader go home and ask the servant to kindle a fire in the furnace in the tenth part of a second, and after it burns for an equal length of time, let him quench the fire, draw out the ashes and then relight the fire in the same length of time; have the servant do this for hours or even days at a time; this is exactly what happens in the combustion chamber of each cylinder of the motor as it is used in an automobile.

The average automobilist will be quite satisfied if the servant succeeds in kindling the fire in ten minutes, nor will he be requested to draw the fire for at least a day. Now the fire that the servant can kindle in ten minutes will not be a tenth part as hot, nor burn with anything like the fury of the fire that is kindled in the combustion chamber of a motor, and yet it is hoped that by study and investigation the efficiency of the fire in the combustion chamber of the motor may be increased, not a little, but greatly.

Could this plan be used in the furnace at home? Why not? But that is a story which has to do with the heating of dwellings, and the plan here is to tell about automobile work. At the same time in making a comparison it is desirable to use a practical simile, otherwise it would be without force. One of the great difficulties attending automobile motor work is to control the heating and turn as much of it into mechanical work as possible. It is mechanical work that propels the automobile, and it is controlled heat that furnishes the energy for the power.

It is a great misfortune that barely 16 per cent. of all the heat of the fire in the combustion chamber of the motor is turned into power to propel the automobile, and it is an equally great misfortune that the rest of the heat, in addition to being a loss, is the source of much trouble—nearly all the trouble, in fine, that a motor is heir to. As an academic proposition it is possible to realize about 20 (or even 25) per cent. of the heat of the fire in mechanical work; the lower value, 16 per cent., is a good practical figure, and there are many motors that would be considered as doing well were they delivering 12 per cent. of the fuel heat as mechanical work.

How is the task accomplished? By what agency is it possible to light a fire ten times per second, take the heat out of it,

turn it into mechanical work, and make automobiles go along the road without requiring the automobilists to get out and push, or, as some have had to do, hire a horse to pull them? Energy does the work. The energy has to be procured. The next task is to harness it. Horses obtain energy from barley, oats, corn and hay. The energy in the food that the horses digest is measured in exactly the same way as the energy that is put into the combustion chamber of the motor is measured, and, strange to relate, it is energy abstracted in the same way in the horse as it is abstracted from the food put into the motor. The horse eats grain and hay, burns it in a furnace, and instead of allowing the energy to dissipate in the form of heat, stores it up in the form of muscular potenial, which is utilized as the occasion demands. The very same character of oxygen that is allowed to enter the combustion chamber of a motor for the purpose of oxidizing the fuel is taken from the same source (the air) by the horse to oxidize the fuel (food) it eats, and the result is the same—the food is burned.

Acceptability is a property of food, or fuel, call it either, with equal force. The horse eats hydrogen, carbon and oxygen, also nitrogen, as these elements are compounded in the fuel that grows on trees, shrubs and other verdure; the automobile motor eats hydrogen, carbon, nitrogen and oxygen, taking these elements from hydrocarbon liquids and the air; steam engines through steam boilers, eat hydrogen, carbon, nitrogen and oxygen, taking in the food in the form of coal and from the air; it is the air that furnishes most of the oxygen, with which nitrogen is associated in the ratio of about 82.5 to 17.5, and while the nitrogen is inert (possesses absolutely no fuel value) it does serve as an agent for diluting the fiercer foods, thus making them more acceptable.

Designing Problem Involved in Acceptability

The ability of a horse to exert a draw-bar pull on a wagon is measured by the sturdiness which comes from stored muscular energy, but tracing back to the source it will be found that the horse's digestive organs must be in shape to assimilate the food or fuel; the same is true in a motor, fuel is utterly wasted unless its digestive organs are properly toned and so co-related that fuel indigestion will not transpire. It is a mere trick of the tongue to call oats by the name of food and gasoline by the appellation "fuel." In a sense, the oats that the horse eats is fuel, and the gasoline that the motor drinks is oats.

The right state of mind for a proper understanding of the whole situation is when food is measured as to its value from two points of view, *i. e.,* (a) based upon the ability of the animal to assimilate and (b) the heat units contained in the food. According to this reasoning gasoline, which holds nearly 20,000 heat units per pound, would be a most efficacious food for a horse. The reason why it is not, however, is due to the lack of ability of the horse to assimilate gasoline.

Transferring the idea to a motor for the time being, and for the purpose of making this question of assimilation as clear as possible, it remains to observe that one reason why motors are better than horses is that they are capable of assimilating the fiercer foods, as gasoline. But all motors are not alike in this respect; and it is for this reason that the A. L. A. M. formula does not apply as a matter of cold hard fact. The horsepower of a motor depends upon its ability to assimilate gasoline, just as the draw-bar pull of a horse depends upon his ability to digest oats.

The A. L. A. M. formula interpreted states "the horsepower rating of a motor may be found by squaring the diameter of the cylinder bore, multiplying by the number of cylinders, and then dividing by 2.5." This method of procedure has the virtue of fixing a constant which bears a mathematical relation to the same character of constant as is deduced from the data of motors to be compared. It is a fallacy to suppose that this constant is very definitely related to the horsepower of the motor. A study of the method of deriving the constant shows that it does not take into account the thermic relations; it is in no way modified by the degrees of assimilation, so-called, of the motors, although it is based upon the use of gasoline as the food or fuel; that is to say, the divisor in the formula is an approximation which takes into account the piston velocity of motors, fixing it at 1,000 feet per minute, a four-stroke cycle and water-cooling.

When a designer lays down the "keel" of a motor he is of course influenced by precedent, data is accumulated from the many sources, and vogue puts its mark on the whole proceeding. What the designer hopes to accomplish is that which will prove that the A. L. A. M. formula will not figure out the proper horsepower rating of his motor. This rating represents an average approximation, as it were, and the designer who recognizes ambition as his task-master, works upon the digestive organs of his new creation rather with the expectation that he will improve the assimilating ability of the machine for gasoline, and he knows perfectly well that for a given displacement, the motor must be capable of using more gasoline than is common to motors of the same size; but the mere "lapping up" of fuel is no very good sign of power—the fuel must be assimilated.

The Horse Serves as a Mile-Stone

Going back to the animal for a simile, it will be remembered that the horse has one peculiar property that the automobile motor does not possess; the horse eats oats to-day in order that he will be able to draw a cart to-morrow; the horse, then, is a secondary battery, possessing the peculiar ability of assimilation plus storage. In the automobile motor, the gasoline is stored in a tank, but as it is taken into the motor's digestive organs, it must be used forthwith, and in order to obtain the best results the power of the motor must also be utilized just as it is produced, limiting the property called "storage" to that as it obtains in the flywheel of the motor in which the power produced during one cycle is distributed over four such cycles. As a storage basin for energy, an automobile motor is almost a failure. If the speed of the crankshaft is 2,000 revolutions per minute, the period of a cycle is 0.01 of a second. With four such cycles the storage ability of the flywheel is confined to narrow limits, taking place within a little over 0.03 of a second.

There are compensating factors in connection with the automobile motor as compared with the horse; admitting that the horse is capable of storing energy to-day and distributing it in a useful form to-morrow, it still remains to feed the horse to keep him alive so that he will animate when the energy is wanted. In the case of the automobile motor, in which the energy must be used as fast as it is produced, it is really an advantage to be able to store the gasoline in its "granary" (tank) and spill it out into the motor at a slow and advantageous rate so that the dispensation of fuel will barely comply with the demand of the moment for power. If power is not wanted from the gasoline motor, it may be shut down and the fuel may be locked up in the tank, where it will remain without deterioration, the cost of feeding the motor to keep it alive, as in the case of the horse, being forestalled.

When the designer casts about for the ways and means of doing better than that which precedent indicates, he abandons the idea that he can figure out how much power the motor will deliver merely upon deciding as to the bore and stroke, and he begins to consider the thermic relations and how he can alter them for purposes of harmony, hoping, perchance, that he can burn more fuel within a given displacement of the motor in a less time, producing, as a by-product, carbonic acid and water, remembering, of course, that all of the nitrogen that is taken

in with the mixture will come out as nitrogen, it being inert.

In the literature of the day in relation to automobiles and things akin thereto, it reads so perfectly that the average automobilist is likely to reach the conclusion that it is vying with perfection. Such a conclusion would be remote from the truth. It is not too much to state that the automobile motor is a marvelously perfect power device; the thermal efficiency approximates 25 per cent. in the very best examples, whereas the thermal efficiency of an ordinary, but good, steam engine, is about one-third of this, or 8 per cent.

It is rather nice to contemplate the future of the automobile motor; it has moved up from a position of marked indifference to the point where it ranks as the most economical transformer of energy of which there is any record. It is a great thing to be able to say that a little 25-horsepower, 4-cylinder motor will deliver 25 per cent. of all the energy that is put into it into mechanical power at the other end, and this, too, in the face of the fact that a 30,000-horsepower quadruple expansion steam engine, under all the advantages of constant loading, as it rests in the lower hold of an ocean greyhound, will only deliver 17 per cent. of the calorific in the fuel that is used in the process. It was only the other day that we had occasion to remark that a ton of coal is the most efficient storage battery in the world, but we overlooked the fact that convenience should be considered as well as efficiency.

Automobile Fuel Influences Thermic Conditions

Since an automobile motor is so designed that the fire may be kindled within the cylinders, applying heat directly to the moving pistons, it is extremely convenient to use that kind of a fuel which will leave no ash residuum. The advantages derived by this direct application of heat would be entirely offset were coal put into the cylinders instead of liquid hydrocarbon fuel; the products of combustion with coal as the fuel include something like 110 pounds of non-inflammable solids per ton of coal, whereas the product of combustion of automobile gasoline, under proper conditions, leaves the merest trace of carbon. Going back to the question of assimilation for the moment makes it possible to point out that pound for pound gasoline is a better storage battery than coal, first, because it has more heat units per pound, and second, because it is more readily assimilated by the motor. It would be a good grade of coal that would analyze up to 14,000 British thermal units of heat per pound, whereas hexane, according to the following table, shows 18,770 British thermal units per pound.

CALORIFIC AND OTHER DATA OF AUTOMOBILE GASOLINE

Petrol	Density at 15° C.	Calorific Value (Lower) Calories per grm.	Calories per c.c. at 15° C.	B. T. U. per lb.	B. T. U. per Imperial gal. at 15° C.
Bowley's special	.684	10,660	7,290	19,190	131,500
Carless	.704	10,420	7,340	18,760	132,300
Express	.707	10,020	7,080	18,040	127,600
Ross	.714	10,370	7,400	18,670	133,600
Pratt	.719	10,340	7,430	18,610	134,100
Carburine	.720	10,380	7,470	18,680	135,000
Shell (ordinary)	.721	10,400	7,500	18,720	135,300
Dynol	.725	10,290	7,460	18,520	134,600
Simcar Benzol	.762	9,490	7,230	17,080	130,400
760 Shell	.767	10,140	7,780	18,250	140,300
Coaline	.846	9,270	7,840	16,690	141,500
Pentane	.630	10,230	6,450	18,410	116,300
Hexane	.680	10,430	7,090	18,770	127,900
Heptane	.736	10,400	7,650	18,720	138,100

The tabulation shows that hexane, which is the principal constituent in automobile fuel, has a density of .68 of the density of water, and that pentane, with a density of .63, is probably the most volatile of the hydrocarbons that is likely to be found in automobile gasoline. All the other brands of fuel named are higher in density than hexane, although the so-called Bowley's special is but slightly heavier than hexane, which might lead one to believe that it is composed almost wholly of this hydrocarbon.

In trying to arrive at a good basis for thought in the explanation of the property here termed "assimilation," it will be impossible to make progress without carrying along the relating characteristics of the fuel that must be used. The probabilities are that many designers have fallen short of their high ideals, failing to note the point that the calorific of the fuel decreases with increasing density. But if they failed in this regard, how thoughtless it was of them to overlook the fact that the volatility of the fuel increases with the calorific!

It is admitted in every designing establishment that compression has a marked influence upon the efficiency; in other words, the ability of the motor to assimilate. It is also conceded that this essential characteristic increases with increasing compression almost up to the point of pre-ignition. It is of course seriously questioned as to whether or not the motor should be designed with the highest obtainable compression or should be held to a lower level, thus trading off something in favor of flexibility. Going a little out of the way for an illustration, may it not be said that nitro-glycerine would be a very excellent fuel? Nor is its efficacy influenced by compression; but it lacks one virtue which we all admire in that its poor reliability under every-day conditions of service is at a low ebb.

High compression motors are noted for their ability to assimilate automobile gasoline under certain fixed conditions of performance, as in racing automobiles. In touring service, or when freight automobiles are considered, the motor is required to run at widely varying speeds, and the demand for power scarcely averages more than one-third of the ultimate ability of such motors. Flexibility of performance is quite as necessary as efficiency under these conditions, and this property is in better presence if the compression is sufficiently reduced to about pre-ignition, or a tendency for overheating.

Power and Flexibility Depend Upon Ignition

Referring to Fig. 1 it will be seen that the volumetric efficiency of a motor decreases slowly at first, as the speed increases, then a little more gradually with further speed advances, and finally the compression resulting reduces at a rapid rate ending with the stalling of the motor, it being the case that if the compression decreases so will the mean effective pressure, and since the power depends upon the mean effective pressure, it naturally follows that any serious reduction in this factor is concomitant with an equal reduction in the power available.

As an incident of the problem it is necessary to consider the characteristics of the fuel that is to be used in a given case. If the same is of a particularly non-volatile character, as when kerosene oil is used, there will be difficulty in starting the motor, and, unless the compression is regulated in view of this fuel, it is more than likely that there will be an absence of efficiency as compared with that which should obtain. This will be in the face of the fact that the thermal value of kerosene oil is not so very different from the thermal value of the better grades of automobile gasoline. Then, there is the question of the formation of carbon, it being the case that some grades of kerosene oil are more susceptible in this regard than are others.

Next to kerosene oil come the composite fuels that are rich in the less volatile hydrocarbons, and there is but little doubt but that much of the automobile gasoline that is bought at the "store" is faulty in more ways than one. When the average automobilist finds himself in a quandary, owing to the lack of good performance, it will be wisdom on his part to first determine to what extent inferior gasoline is at the bottom of his predicament and then go on with the investigation, with the assurance on his part that he is coping with a class of trouble that can be adjusted through the deft use of a screwdriver.

That the mean effective pressure must be maintained at the highest possible level is shown by scanning a simple formula involving the same as follows:

Let,

I.H.P. = The indicated horsepower of the motor from which the mechanical losses must be subtracted to obtain the (D.H.P.) delivered horsepower;

A = Area of the piston in square inches;

Ps = Stroke of the piston in feet counting power strokes;

Mp = Mean effective pressure on the piston throughout the stroke in pounds per square inch;

When,

$$\text{I.H.P.} = \frac{Ps \times A \times Mp}{33{,}000} \quad \text{(per cylinder)}.$$

$$Mp = \frac{\text{I.H.P.} \times 33{,}000}{A \times Ps}$$

$$A = \frac{\text{I.H.P.} \times 33{,}000}{Mp \times Ps}$$

$$Ps = \frac{\text{I.H.P.} \times 33{,}000}{A \times Mp}$$

Inspecting the formula discloses the fact that the horsepower of a motor is directly proportional to the piston travel in feet per minute, the area of the piston in square inches, and the mean effective pressure. Obviously, increasing any one of these factors will have the effect of increasing the power of the motor in the same ratio, so that the reverse must hold true; that is to say, if any one of these factors is diminished, the power of the motor will diminish in the same ratio.

It happens to be true that the area of the piston cannot be varied by any process which is available to the operator after the motor is made. The remaining two factors, *i. e.*, piston travel and mean effective pressure, are correlated, and it follows that if one of them is diminished in value the other will fall off accordingly and vice versa. Following along in this vein of reasoning, it may be pointed out that the piston travel is a mere matter of interpreting the rotation of the crankshaft, transforming the angular motion into its reciprocating complement, and so it would seem that the mean effective pressure is the value which must be dealt with skillfully since it is of primal importance, and if the power of the motor increases or decreases, it will be at the expense of a change in the mean effective pressure.

What Influences the Mean Effective Pressure?

Setting down the factors which will have bearing upon the mean effective pressure categorically results in the following:

(A) The quantity of fuel which is burned advantageously;

(B) The amount of back pressure encountered;

(C) The loss of heat to the water jacket;

(D) Loss of heat to the exhaust;

(E) The time of consummation of the power cycle;

(F) The depression in the intake;

(G) Leakage during the compression stroke.

Taking up the question (A) it is of course true that the amount of power which can be wrung from a motor depends upon the amount of fuel actually burned advantageously. Since it was shown that the power is directly proportional to the mean effective pressure, it of course follows that the mean effective pressure will be increased in a given motor in proportion as the fuel is burned to finality under advantageous conditions.

Presupposing that the carburetion is conventionally perfect, the further questions of the advantageous burning of the fuel may be referred to Fig. 2, and to the diagram (a) in which it will be observed that the maximum pressure after ignition is barely 140 pounds per square inch, and repeated trials, using a poorly timed coil ignition system, brought no better result, although with a compression of 50 pounds (gauge) the maximum pressure fell as low as 80 pounds per square inch. Referring to (b) in the same figure, with a somewhat better timing but using a coil ignition system, the variations following repeated trials were much less marked when the maximum pressure reached 188 pounds per square inch.

Transferring the attention to Fig. 3 of a set of manograph cards, (a) shows an explosion pressure of 320 pounds per square inch, and that the spark was well timed, but it is pointed out that the speed was only 640 revolutions per minute, and it is worth noting in this case that the spark plug was located in the region of the inlet valve. Increasing the speed to 1,100 revolutions per minute had the effect of reducing the maximum pressure down to 240 pounds per square inch, thus indicating that, while good timing could be maintained, increasing the speed had a marked bearing upon the maximum pressure and a planometer reading would probably show that the mean effective pressure decreased a little, although, as will be readily appreciated, the mean effective pressure of a motor is not proportional to the maximum pressure. When the speed was increased to 1,600 revolutions per minute, the maximum pressure varied considerably with repeated trials, although it held on one or two occasions to about the same level as that which was obtained in (b). But there were other evidences of the ills due to speed, as, for illustration, the depression (below the atmosphere) increased, and the shape of the boundaries of the en-

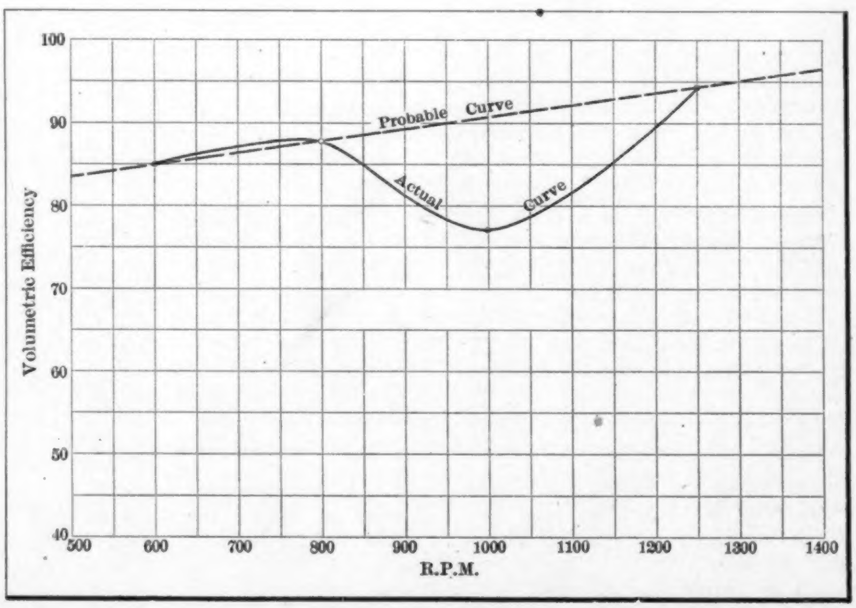


Fig. 1—Chart contrived to indicate the volumetric efficiency of a motor at different speeds

closed area of the indicator card changed considerably without indicating a corresponding advantage.

As a further measure of the several influences upon the mean effective pressure of a motor, reference may be had to Fig. 4 showing the performance at three different speeds when the ignition took place through spark plugs placed in the region of the exhaust valves. The curve (a) at 640 revolutions per minute reached a maximum of 310 pounds per square inch, and while the timing of the spark was a little off perfection, the shape of the curve is characteristic. Increasing the speed to 1,100 revolutions per minute produced a curve with a ragged contour, as shown in (b) and the maximum pressure fell away to 250 pounds per square inch, varying down to 205 pounds per square inch during repeated trials. Increasing the speed to 1,600 revolutions per minute added to the ragged boundaries of the curve and subtracted from the maximum pressure to an approximate mean of 225 pounds per square inch during repeated trials, showing also that the mean effective pressure was undoubtedly less than that due to placing the spark plugs on the inlet side as depicted in Fig. 3.

Advancing the methods of observation leads to the condition as depicted in Fig. 5, in which two simultaneous sparks at different speeds brought about a correction of the evils above noted; glancing at (a) in the figure, it will be observed that the maximum pressure increased to 325 pounds per square inch when the speed of the motor was 640 revolutions per minute. Increasing the speed to 1,100 revolutions per minute, under the same conditions of sparking, altered the boundaries of the manograph curve but slightly, nor did the maximum pressure reduce beyond a mere trifle. This would not be considered so remarkable a performance were it not for the stability shown when the speed was increased to 1,600 revolutions per minute; the maximum pressure continued at about the same level as before, and the area of the manograph card was maintained with great persistence, although the expansion line looks a little ragged, which might be an indication of approaching deterioration of the good conditions obtaining, but there is no evidence to show that the motor might not have performed extremely well at a considerably higher speed. This is in marked contrast with the performance as shown in Fig. 3, which, in itself, was better than when a single sparking system was employed with the spark plugs located on the exhaust side as shown in Fig. 4, and it would seem quite safe from this, and other evidence of a like character, to reach the conclusion that the property which we are pleased to term "assimilation" is in its best form under the conditions as presented in Fig. 5, taking advantage of an efficient spark, well timed, utilizing the same at two remote points in the gas body, and it is just possible that the good which is shown by multi-sparking would be augmented by using three or more sparking points, thus reducing the distance of travel of flame in the gas body so that there will be no burning of the gas during the downward migration of the piston on the power stroke.

It should be generally understood that the best results are realized if the gas is burnt while the piston is on the dwell point preceding the power stroke. The swelling of the gas, due to burning, will then produce the maximum pressure because the space in which the increasing pressure transpires will be constant. The practice of advancing the spark was introduced to overcome some of the difficulty in this connection; it was thought that it would be better to fire the charge during the compression stroke rather than to delay the firing operation and continue the burning of the gas during the power stroke. Practice has shown that the lesser of the two evils is present if the gas is fired early, but there is a negative component involved in this process because if the compression is increased by the burning of the gas during the compression stroke more power is required to complete the compression stroke, and all the power utilized in compressing the mixture must be subtracted from the power of the motor.

The idea which is uppermost in the plan involving the use of two simultaneous sparks has for its foundation the aborting of the necessity for advancing the ignition to a point where the compression pressure will be augmented above the normal level, and at the same time complete the burning of the mixture before the piston starts on its downward migration on the power stroke. Should this plan be carried to its logical conclusion, the sparking equipment would have to be so efficacious that the gas would be ignited at the end of the compression stroke, and it would be burned to finality during the period of the dwell of the piston intervening between the ending of the compression and the beginning of the power stroke. Under these conditions, the negative pressure, due to early ignition, would be avoided, and the positive pressure, due to rapid inflammation, would be a maximum.

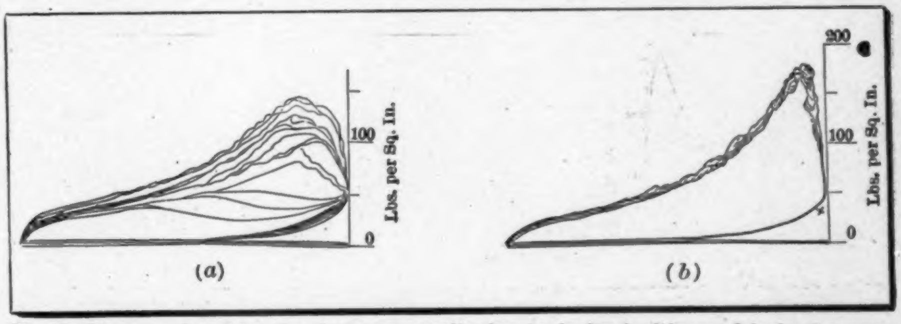


Fig. 2—Manograph cards, showing poor results due to faulty ignition and lack of proper timing

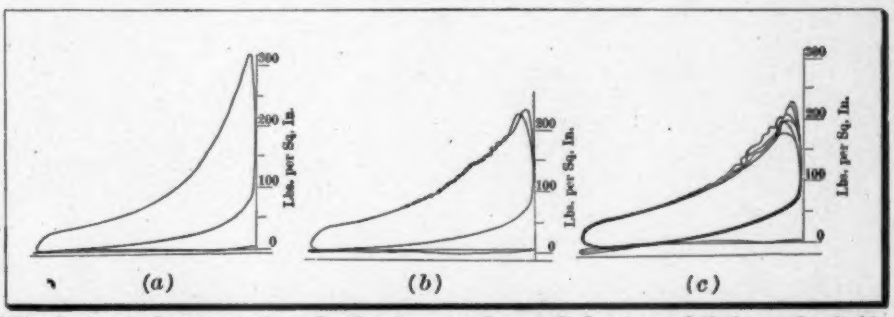


Fig. 3—A set of manograph cards, showing superior result due to good timing and suitable mixtures; but increasing speed shows a falling-off of pressure

Gas Inertia and Other Retarding Influences

Advanced designers deal with the travel of the gas on its way to the combustion chamber, taking cognizance of the weight, however slight, of the gas body, figuring upon the losses due to acceleration and inertia, and what they aim at is a constant velocity of the gas, which, if it could be attained, would eliminate all inertia and losses due to acceleration. There are two considerations which serve as stumbling blocks in the attainment of these ends, the first of which must be attributed to the cyclic relations, and the second to the impracticability of shap-

ing cams so irregularly as to permit the gas to travel through the valve-opening at a constant rate.

Symmetrical cams, while they reduce the regular flow of gas, are mechanically more in keeping with all around good performance, and so they are utilized as being the lesser of the evils. Measuring the intake pressure shows that it varies not only with the speed of the motor, but between crank angle increments and, subdividing these variations, they may be assigned to the respective causes, the first of which is due to a symmetrical cam, and the second to wire drawing, which increases with the speed of the crankshaft, hence with the speed of flow of the mixture through the carbureter to the combustion chamber. Fig. 6 will suffice to indicate the characteristic performance of conventional poppet valve motors in which the crank angle relation is plotted as ordinates, and the suction pressure in pounds per square inch is given values as abscissæ. In this particular example of the varying pressure in the induction pipe a 4-cylinder motor was used and at 665 revolutions per minute the maximum depression occurred between 65 and 135 degrees, which depression amounted to —1.35 pounds per square inch. At this speed the inertia component was maximum at 30 degrees crank angle when the pressure reached 0.2 pound per square inch above the atmosphere.

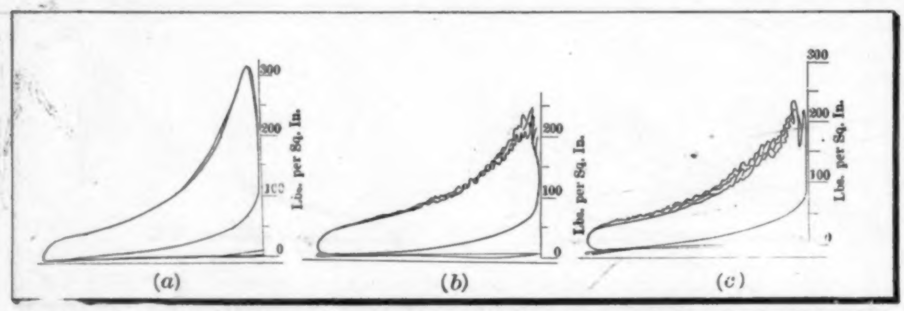


Fig. 4—Set of manograph cards, showing relatively poor result due to placing of the spark plugs in the region of the exhaust valves

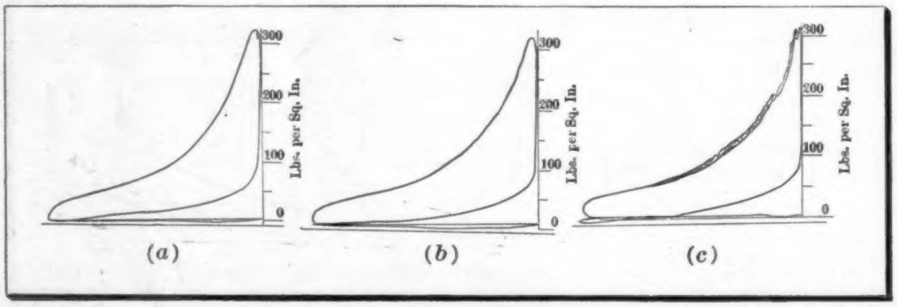


Fig. 5—Set of manograph cards indicating excellent results due to the use of two sparks simultaneously

In the same figure, when the speed was increased to 860 revolutions per minute, the maximum depression began a little later as measured by the crank angle but was somewhat prolonged. The greatest depression at this speed was —1.85, and the best result as indicated by inertia was 0.1 pound per square inch above the atmosphere. Advancing the speed to 1,200 revolutions per minute altered the shape of the curve entirely; the depression increased to —2.3 and the inertia component was maximum at 50 degrees crank angle measuring —0.3, which is a very poor result as compared with the performance at the lower speeds.

The novice would jump to the conclusion that the depression in the induction pipe could be reduced by the simple expedient of using a pipe of a larger diameter. This remedy would be efficacious were the motor to run at a high speed all the time, assuming, of course, that there would be some way which would permit of starting the motor other than that which depends upon a depression in the induction pipe under conditions of starting speed. Flexibility would be absent were the area of the induction pipe increased beyond a certain point, for then the depression would be but slight at the lower speeds, and the travel of the mixture in feet per minute might fall below the sweep of the flame within the mixture so that, instead of benefiting the situation by reducing the wire-drawing effect, it would be complicated instead, resulting in a motor that would not start readily by cranking, and one as well that would have the popping back characteristic, which, of course, defeats all attempts at varying the power by altering the richness of the mixture.

In a flexible motor means must be afforded for varying the power independent of speed variations, and at times altering the speed of the motor without varying the power. Such a motor would deliver power in direct proportion to speed over a wide range of performance with means for maintaining the ratio of gasoline to air, and it is by changing the ratio of gasoline to air that the power may be varied at a constant speed, or the speed may be altered at a constant power. These considerations are more or less independent of the volume of mixture that may be permitted to enter the combustion chamber on the induction stroke.

Silence Is At the Expense of Power or Flexibility

Were it not for the desire to eliminate noise it would be quite easy to improve the performance of motors, for then it would be possible to use relatively large valves and a considerably higher compression than that of normal practice in silent motors. If the valves are large they will permit of the entrance of a large amount of gas in a given time, and the area of the induction pipe may be somewhat restricted for the good of the service in other directions, but if the valves are large and the compression is high the closing operation will be noisy, due to heavy seating, and the opening operation will be defective in the same way, due to high pressure on the bearing surfaces (a) of the cam with the roller, and (b) of the lift against the valve seat or to other resistances as undue friction.

In the search for silence the valves are restricted as to size, and the compression is reduced considerably so that the rate of flame travel in the gas body is relatively slow, the pressure on the valve mushrooms is less, the seating of the valve under such conditions being quiet, and the clatter of the lifts falls off under the same influence. There are other benefits to be derived from the noiseless performance point of view when the pressure is low and the valves are relatively small. It will be understood that if the gas burns at a slow rate the maximum pressure on the piston will be perhaps 200 instead of 300 pounds per square inch, and the acceleration of the reciprocating mass will be at a lower rate per second in a second. The result will be that the pressure on the connecting rod and crankshaft bearing will be softer and the torsional angle of the crankshaft due to the twisting moment will be less. All of these and other considerations resound to the account of silent performance, but the power of the motor will be considerably lowered, although from the point of view of the average automobilist he will be much more pleased, and in all fairness if the motor delivers

enough power to drive the automobile at a satisfactory speed he will be in an advantageous position, all things considered, because silence and smooth running are assets which are not to be denied, and it certainly is consoling to feel that the motor will last for a longer time at a considerably restricted cost of depreciation.

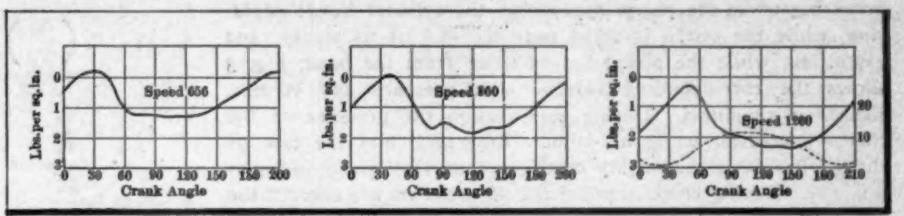


Fig. 6—Presenting three charts of pressures at three speeds for the purpose of noting the pressure variations at different crank-angles

The reform in motor designing started more than a year ago, and all of the advanced designers took cognizance of the difference between motors for racing purposes and those which would be expected to serve efficaciously in touring work. The original craze for light weight and high speed, coupled with all the disadvantages of a "hard" motor, was finally relegated to the realm of speculation and of racing, nor did it take many years under actual practical conditions to turn the attention of automobilists to the fact that an automobile can be too light as well as too heavy. A study of the problem involving relative weight and the disposition of the units and the mass rendered it possible to see an actual advantage in a "soft" performing motor, partly due to a somewhat greater weight in view of the location of the motor in the chassis, and for the rest on account of the added flexibility which comes as a sequence of design.

In considering the question of weight and the disposition thereof, the experienced automobilist will appreciate the fact that a relatively light chassis rendered top heavy by a massive limousine body will be the possessor of a distinct disposition to turn turtle. It is a great mistake to assume that the laws which govern the designing and building of ships are rendered futile simply because the ships have wheels upon them and roll along the ground. A plain statement of fact compels utterance in favor of the contention that an automobile from the designer's point of view is just as much of a ship as a cargo-lugger or a "greyhound." Each of them obey natural laws, and the center of gravity of a ship, if it is high, will make it float bottom side up or sink, but why should it be considered strange if the same thing happens to an automobile? It is true, of course, that the automobile, when it is standing still, is supported by four legs called wheels, but they cease to be legs as soon as the car is set into motion and the conflicting forces of nature take control.

When a car is turning a radius it tends to float off in a tangent, but if the weight is not distributed equally over the front and rear wheels the lightest end will float off first, and then the car will take on several directions of travel which the automobilist calls "skidding" in front or rear as the case may be. But if the weight in the vertical plane is centered at a distance quite high up from the ground the automobile also tends to rotate on a fore and aft axis, resulting usually in the turning over of the car, the two outer wheels finally serving as the axis of rotation.

Power Calculations for Motors

POWER AND PISTON DISPLACEMENT; ACTION IN CYLINDERS; ASSUMED CONDITION; LIMITS; VOLUME RATIOS; FORMULA FOR TRACTIVE POWER; PISTON SPEED RATING; PROPORTIONS, ETC. BY W. D. ENNIS, PROFESSOR OF MECHANICAL ENGINEERING, POLYTECHNIC INSTITUTE OF BROOKLYN

THE custom of rating the horsepower of gasolene automobile engines in terms of cylinder diameter and stroke, piston speed, etc., has a sufficiently good foundation, but the ability of a motor to do the work required of it appears to depend upon certain factors not contemplated in ordinary empirical formulas. Ordinary empirical expressions for horsepower are then of little significance either to the designer or the operator. It is the purpose of this paper to suggest a method for determining the (water-cooled) cylinder dimensions suitable for required service regardless of horsepower rating, for which rating there is insufficient justification.

Power in Relation to Piston Displacement

Fundamental Expression—Let a gas, or a mixture of gases, change its condition from the state 1 to the state 2, Fig. 1, in such a manner that

$$P_1V_1^n = P_2V_2^n = PV^n = \text{a constant.} \qquad \text{(I)}$$

P representing pressure in pounds per square inch; V representing volume in cubic feet, and n having any positive value exceeding unity. Then if T denote absolute temperature (Fahrenheit temperature plus 460), we have

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} = \frac{PV}{T} \qquad \text{(II)}$$

$$\left(\frac{P_1}{P_2}\right)^{\frac{n-1}{n}} = \frac{T_1}{T_2} = \left(\frac{V_1}{V_2}\right)^{1-n} \qquad \text{(III)}$$

$$\frac{P_1}{P_2} = \left(\frac{V_2}{V_1}\right)^n \qquad \text{(IV)}$$

and the work done during expansion from 1 to 2 (or negatively during compression from 2 to 1) is, in foot-pounds,

$$\frac{144}{n-1}(P_1V_1 - P_2V_2). \qquad \text{(V)}$$

Also, if such gas or mixture increase in temperature without changing its volume from the state 1 to the state 3, Fig. 2,

$$\frac{P_1}{P_3} = \frac{T_1}{T_3} \qquad \text{(VI)}$$

Action in the Cylinder—In the power stroke of an internal combustion engine there are three principal events: ***compression,***

occurring while the piston approaches the cylinder head; *explosion*, while the piston is at or near the end of its stroke, and *expansion*, while the piston moves away from the head. Fig. 3 shows the corresponding variations in pressure and volume, somewhat simplified. During compression the pressure of the charge increases, while its volume decreases, and the law of change has been thoroughly established as that given in equation (I). During combustion, if the adjustments are correct, the pressure and temperature may be considered to increase very rapidly, while the volume remains nearly constant. During expansion the pressure falls and the volume increases, again according to the law expressed in equation (I).

Work Done—During expansion the work done *on the piston*, Fig. 3, is in accordance with equation (V),

$$\frac{144}{n-1}(P_3V_3 - P_4V_4). \qquad \text{(VI)}$$

During compression the piston must do work *on the charge*, amounting to

$$\frac{144}{n-1}(P_2V_2 - P_1V_1). \qquad \text{(VII)}$$

The net amount of work done *on the piston* during the whole power stroke is then

$$\text{(VI)} - \text{(VII)} = \frac{144}{n-1}(P_3V_3 - P_4V_4 - P_2V_2 + P_1V_1). \qquad \text{(VIII)}$$

But $V_3 = V_2$ and $V_4 = V_1$; hence

$$\text{(VIII)} = \frac{144}{n-1}\left\{ V_2(P_3 - P_2) + V_1(P_1 - P_4) \right\} \qquad \text{(IX)}$$

Assumed Conditions—The only terms in equation (IX) of which we have first-hand knowledge are n, P_1, and (sometimes) P_2, the values of which may be:

TABLE I.

	Normal	Minimum	Maximum
n	1.30 to 1.33	1.29	1.38
P_1 (2-cycle)	20	18	21
P_1 (4-cycle)	12	12	14
P_2	70 to 90	45	106

Our proper basis for computations rests upon assumptions as to three temperatures, T_1, T_2 and T_3. The first of these is *not* the temperature of the charge admitted to the cylinder, but rather that of the charge at the beginning of the compression stroke after it has been somewhat heated by the cylinder walls. The temperature T_2 is limited by the allowable amount of heating without preignition of the charge, and for gasoline may be assumed at 600 deg. Fahr., or $600 + 460 = 1{,}060 = T_2$. For the maximum temperature T_3 we have no direct measurements; it may be taken at $3{,}000 + 460 = 3{,}460$. Then by combining these values with those in Table I, and by making use of equations as noted, we obtain:

TABLE II.

		Limits Between Assumptions		
		Normal	Minimum	Maximum
1.	T_1 (assumed)	660	760	600
2.	$\frac{V_2}{V_1} = \left(\frac{T_2}{T_1}\right)^{\frac{1}{1-n}}$ (equation (III))	0.206	0.4155 (a)	0.1400 (b)

(This would lead, for a 2-cycle engine, in case (b), and for a 4-cycle engine in either of cases (a) or (b), to pressure variations at the point 2, Fig. 3, beyond those adopted in practice. We will adopt the value of $\frac{V_2}{V_1}$ thus computed for the 2-cycle engine only, case (b) only, and proceed further, as follows:—)

		Normal	Minimum	Maximum
3.	P_2 (assumed)	93	45	100
4.	$\frac{V_2}{V_1} = \left(\frac{P_1}{P_2}\right)^{\frac{1}{n}}$ (equation (IV)) (2 cycle)	—	0.6539	0.2646 (c)
5.	$\frac{V_2}{V_1} = \left(\frac{P_1}{P_2}\right)^{\frac{1}{n}}$ (equation (IV)) (4 cycle)	0.206	0.3834 (d)	0.2175 (e)

(Values (a), (line 2); (c), (d) and (e), (line 5), are now adopted).

		Normal	Minimum	Maximum
6.	$P_2 = P_1\left(\frac{T_2}{T_1}\right)^{\frac{n}{n-1}}$ (equation (III))	—	70.6 (Case (a) only)	—
7.	$P_3 = P_2\frac{T_3}{T_2}$ (equation (VI)) (2 cycle)	—	231	327.4
8.	$P_3 = P_2\frac{T_3}{T_2}$ (equation (VI)) (4 cycle)	307	147.2	327.4
9.	$P_4 = P_1\frac{P_3}{P_2}$ (equation (II)) (2 cycle)	—	68.9	59.0
10.	$P_4 = P_1\frac{P_3}{P_2}$ " (II)) (4 cycle)	37	39.3	45.9

Volume Ratios, Clearance and Piston Displacement—If we write

D = displacement of piston per power stroke, in cubic feet,

we have, letting a denote the ratio $\frac{V_2}{V_1}$ taken from Table II, lines 2, 4 or 5,

$$V_1 - V_2 = D$$

$$\frac{V_2}{V_1} = a,$$

$$V_2 \doteq aV_1,$$

$$V_1(1-a) = D,$$

$$V_1 = \frac{D}{1-a}, \qquad \text{(X)}$$

$$V_2 = \frac{aD}{1-a} \qquad \text{(XI)}$$

$\frac{V_2}{D} = \frac{a}{1-a}$ = proportion of clearance.

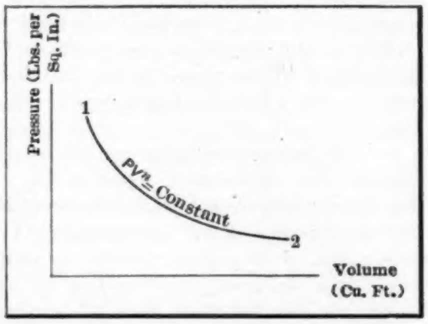


Fig. 1—Curve of pressure and expansion of a theoretical indicator card

Now by combining equations (X) and (XI) with equation (VIII), we obtain for the work done per power stroke

$$W = \frac{144\,D}{(n-1)(1-a)}\left\{a(P_3 - P_2) + P_1 - P_4\right\} \qquad \text{(XII)}$$

The following are the values substituted from Tables I and II, and the results obtained in Equation (XII):

TABLE III.

	Two Cycle		Four Cycle		
	Minimum	Maximum	Normal	Minimum	Maximum
n	1.29	1.38	1.3 (compression) 1.33 (expansion)	1.29	1.38
a	0.2646	0.4155	0.206	0.2175	0.3834
P_3	327.4	231	307	327.4	147.2
P_2	100	70.6	93	100	45
P_1	18	21	12	14	12
P_4	59	68.9	37	45.9	39.3
$(W \div D) = c$	12,900	12,140	9,750	11,020	7,420

Corrections—A corrective factor must now be introduced to cover approximations made in the diagram of Fig. 3, and to reduce the work at the piston to work available at the engine shaft. This factor will range from 0.75 to 0.85 for four-cycle engines and from 0.60 to 0.70 for two-cycle engines, making the five values of $W \div D$ as follows:

$12{,}900 \times 0.70 = 9{,}010$; $12{,}140 \times 0.60 = 7{,}284$; $9{,}750 \times 0.925 = 9{,}000$;
$11{,}020 \times 0.85 = 9{,}360$; $7{,}420 \times 0.75 = 5{,}560$.

To simplify the analysis we will consider the "normal" four-cycle engine only.

Piston Speed—A maximum temperature at the point 3 of 3,000 deg. Fahr. is possible only with good operation, effective carbureter action and well-designed valves and governor gear. Assuming that all these are what they should be, the work obtainable per power stroke in a water-cooled cylinder will still vary somewhat with the piston speed. Maximum power is theoretically obtainable at minimum speeds. At a piston speed of 1,000 feet per minute, the ratio of piston speed to flame speed is

quite appreciable and some expansive work is lost. There is a lack of sufficient data on this question, but it is probably safe to say that no great variation in power occurs at speeds under 400 feet. At higher speeds the loss of power is more rapid than the increase of speed.

Horsepower and Displacement—Let

d = diameter of cylinder in inches,
s = stroke in inches,
r = revolutions per minute.

Then a single cylinder, single acting, has a working displacement per minute of

$$\frac{\pi}{4} d^2sr \div (2 \times 1{,}728) = \frac{d^2sr}{4{,}400} \text{ cubic feet,}$$

or per power stroke of

$$D = \frac{\pi}{4} d^2s \div 1{,}728 = \frac{d^2s}{2{,}200} \text{ cubic feet.}$$

The horsepower developed at the engine shaft (one horsepower = 33,000 foot-pounds per minute) is then (substituting values for the case considered):

$$\frac{cd^2sr}{4{,}400 \times 33{,}000} = \frac{9{,}000\, d^2sr}{4{,}400 \times 33{,}000} = \frac{d^2sr}{16{,}140} \qquad \text{(XIIa)}$$

Alternately, we may write $s = \frac{2\,sr}{12}$, $sn = 6\,s$. and

$$HP = \frac{6\,cd^2s}{4{,}400 \times 33{,}000} = \frac{cd^2s}{24{,}100{,}000} = \frac{d^2s}{2{,}775} = \frac{d^2s}{2{,}679} \qquad \text{(XIIb)}$$

Tractive Power and Piston Displacement

Formula for Tractive Power—In a previous paper (THE AUTOMOBILE for September 29, 1910) on "The Automobile as a Locomotive," the following formula was derived (different symbols have been used in some cases to avoid confusion):

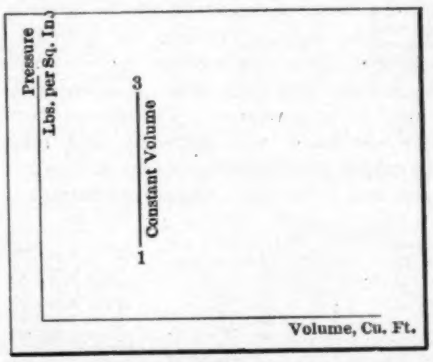


Fig. 2—Diagram constructed to illustrate the characteristics of a constant volume

$$F = \frac{d^2rsP}{2\,Nw} \qquad \text{(XIII)}$$

d = cylinder diameter, inches;
s = stroke, inches;
r = revolutions per minute.
P = average pressure continuously maintained in the cylinder, in pounds per square inch;
N = revolutions per minute of carriage wheel;
w = diameter of carriage wheel in inches;
F = tractive or pulling force in pounds that would be exerted at the wheel rim if there were no friction between it and the engine.

Tractive Power and Work—Let W = cD be the work in foot-pounds corresponding to a piston displacement D cubic feet. Then the corresponding average continuous pressure in a four-cycle cylinder is

$$P = \frac{cD}{4 \times 144\,D} = \frac{c}{576} \text{ pounds per square inch.}$$

$$\left[\frac{9{,}000}{576} = 15.65 \text{ pounds per square inch}\right]$$

Writing $d^2s = 2{,}200\,D$, $sr = 6\,s$, we obtain from equation (XIII) either of the forms,

$$F = \frac{2{,}200\,Drc}{1{,}152\,Nw} = 1.912\,\frac{Drc}{Nw} \qquad \text{(XIV)}$$

$$\left[\frac{1.912 \times 9{,}000\,Dr}{Nw} = \frac{17{,}200\,Dr}{Nw}\right]$$

$$= \frac{6\,Sd^2c}{1{,}152\,Nw} = \frac{Sd^2c}{192\,Nw} \qquad \text{(XV)}$$

$$\left[\frac{9{,}000\,Sd^2}{192\,Nw} = 46.8\,\frac{d^2S}{Nw}\right]$$

This tractive force is exerted through a distance of

$$\frac{\pi wN}{12} = \frac{wN}{3.82} \text{ feet per minute;}$$

and the ideal horsepower at the wheel rim (force in pounds × distance in feet per minute ÷ 33,000) is, from equation (XIV),

$$\frac{FwN}{3.82 \times 33{,}000} = \frac{1.912\,DrcwN}{3.82 \times 33{,}000\,Nw} = \frac{Drc}{65{,}900} \qquad \text{(XVI)}$$

$$\left[\frac{9{,}000\,Dr}{65{,}900} = \frac{Dr}{7{,}300}\right]$$

or, from equation (XV), it is

$$\frac{Sd^2cwN}{192\,Nw \times 3.82 \times 33{,}000} = \frac{Sd^2c}{24{,}100{,}000} \qquad \text{(XVII)}$$

$$\left[\frac{9{,}000\,Sd^2}{24{,}100{,}000} = \frac{Sd^2}{2{,}677.7}\right]$$

Equation (XVII) is, of course, the same as equation (XIIb) if the arithmetical values are accurately worked out, and if in equation (XVI) we write for D its value $\frac{d^2s}{2{,}200}$, we obtain the form of equation (XIIa),

$$HP = \frac{d^2src}{2{,}200 \times 65{,}900} = \frac{d^2src}{145{,}200{,}000} \qquad \text{(XVIII)}$$

Equations (XVII) and (XVIII) or (XIIa) and (XIIb) give the horsepower at the engine shaft at normal or low piston speeds in terms of (a) diameter, stroke and revolutions per minute, or (b) diameter and piston speed. If we assume diameter = stroke, and take our normal value of c at 9,000, then equation (XVIII) gives $\frac{9{,}000\,rd^3}{145{,}200{,}000} = \frac{rd^3}{16{,}133}$ which at 1,000 r.p.m. gives $\frac{d^3}{16{,}133}$. If d = 4 this may be written $\frac{d^2}{4.033}$; and if d = 7, it becomes $\frac{d^2}{2.305}$

Piston Speed Rating—By using equation (XVII), however, we may eliminate one term in our rating formula. Piston speed is as well standardized as r.p.m. A speed of 1,000 feet per minute, with c = 9,000, gives from (XVII)

$$\frac{d^2}{2.68}$$

a close confirmation of the A. L. A. M. formula. (With cylinders of ordinary size a piston speed of 1,000 necessitates a rotative speed greater than 1,000 r.p.m.)

We have not yet considered the falling off in power due to excessive piston speeds. This might be done by giving greater weight to cylinder dimensions than to r.p.m., or piston speed, in rating; *i. e.*, we might in equations (XVII) and (XVIII) write

$$HP = \frac{fS^e d^2c}{24{,}100{,}000} = \frac{fd^2scr^e}{145{,}200{,}000}$$

Where e is an exponent having a value less than unity, and f is a constant multiplier. Let, for example, e = 0.9; then taking c = 9,000, d = 5, from the first of these formulas we obtain

TABLE IV

Piston speed, Feet per min.	S^e	$S^e d^2 c \div 24{,}100{,}000$	Horsepower* (f = 1.85)
200	117.5	1.095	2.0
400	220.	2.050	3.8
500	268.	2.495	4.6
600	316.	2.950	5.45
800	409.	3.800	7.0
1,000	501	4.670	8.6
1,200	591	5.510	10.2

*The product of S^e and f should equal S at normal piston speeds. This would require at 400 ft. piston speed, f = 1.82; at 500 feet, f = 1.87; at 600 feet, f = 1.90, etc. The lost column of the table is calculated for f = 1.85. This may lead to a slight overrating at speeds below about 400 feet, and possibly to an underrating at speeds from 500 to say 700 feet. The results are shown graphically in Fig. 4. The tractive force will also fall off from that strictly corresponding to the cylinder dimensions in the ratio $\frac{fS^e}{S}$.

The absence of complete experimental data on variations of horsepower with piston speed makes a definite formula at present impossible, but it is believed that the following are more logical in form and more widely applicable than the A. L. A. M. expression:

$$HP = \frac{9{,}000\ fS^ed^2}{24{,}100{,}000} = \frac{fS^ed^2}{26{,}777} \qquad \text{(XIX)}$$

$$= \frac{9{,}000\ fd^2sr^e}{145{,}200{,}000} = \frac{fd^2sr^e}{16{,}133} \qquad \text{(XX)}$$

in which

HP = horsepower at the engine shaft obtainable from a single-acting, four-cycle cylinder using gasolene, in normally good adjustment;

f = a constant multiplier (suggested value for the present in (XIX), 1.85);

S = piston speed, feet per minute;

e = an exponent less than 1.0 (suggested present value in (XIX), 0.9);

d = diameter of cylinder in inches;

r = revolutions per minute;

s = stroke in inches.

The factor 9,000 may be taken at 4,000 for a two-cycle cylinder. In other respects the formula suits either type.

Effect of the Transmission

Variations in Tractive Power and Horsepower—There is always a loss between the engine shaft and the rim of the wheel where the power is finally exerted. In a previous paper (in THE AUTOMOBILE for September 29, 1910) the record was given of certain tests showing a tractive power loss in transmission approximately constant at about 50 pounds. The horsepower loss in transmission is then directly proportional to the speed of the engine. While these deductions would not hold for a wide range of speeds they agree fairly well at moderate speed with what is known to be the fact in ordinary locomotive practice. Let g be the constant loss of tractive force in pounds due to friction in the transmission. Then the tractive power F_o actually exerted at the wheels and available for propulsion is

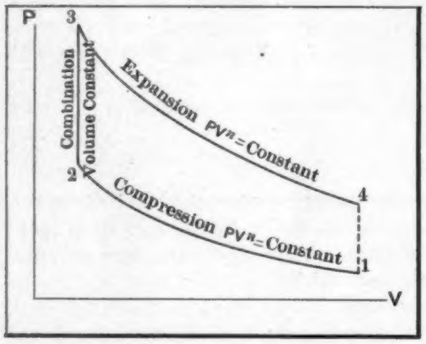


Fig. 3—Theoretical indicator card designed to show the relations of the function.

$$F_o = F - g; \qquad \text{(XXI)}$$

and the net horsepower available for propulsion at the wheel rims is (equation (XIX), (XX)),

$$HP_o = \frac{F-g}{F} \cdot \frac{fd^2sr^e}{16{,}133} = \frac{F-g}{F} \cdot \frac{fS^ed^2}{26{,}777} \qquad \text{(XXII)}$$

Resistances

Air Resistance—In Fig. 6, let a plane surface a b be exposed to a direct normal air current having a velocity of v feet per second, as indicated by the arrow. If there are no eddies, the following relation holds:

$$v^2 = 64.4 \frac{p}{d}$$

in which p is the pressure in pounds per square foot produced on the plane surface by the moving air, and d is the density of the air. Let V be the air velocity in miles per hour. Then

$v = \frac{5{,}280\ V}{3{,}600}$, $v^2 = 2.15\ V^2$; and since **under normal conditions** $d = 0.076$,

$$2.15\ V^2 = \frac{64.4}{0.076}\ p,$$

$$p = 0.0025\ V^2. \qquad \text{(XXIII) (See Fig. 5.)}$$

The same pressure p will be exerted if the surface a b in Fig. 6 moves at a velocity of V miles per hour in still air; or, if the surface moves at a velocity V_1 while the air itself moves at a velocity V_2 either with or against the surface,

$$p = 0.0025\ (V_1 \pm V_2)^2.$$

This last is the condition existing in automobile propulsion. The exposed surfaces in the case of an automobile are not wholly normal to its direction of movement, and the pressure of air resistance per square foot of surface is less than $0.0025\ V^2$. On the other hand, there is a succession of approximately normal surfaces, the front of the radiator, the seat backs, etc., so that the cross-sectional clearance area of the machine does not represent all of the surface exposed to air resistance. The resisting surface for a limousine or landaulet exceeds that for a roadster or touring car; that for a racer may be a little less than that for a pleasure car; that for a truck may be a maximum. The joint effect of surface shape, surface succession and aggregate area may perhaps be represented by taking the following values for resisting areas, A in square feet and P in total resisting pressures:

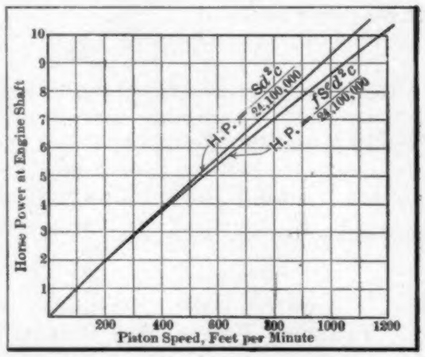


Fig. 4—Chart giving horsepower at engine shaft, piston speed, etc.

TABLE V.

Touring car (top up)	$A = 30$	$P = 0.075\ V^2$
Touring car (top down)	$A = 20$	$P = 0.050\ V^2$
Limousine	$A = 28$	$P = 0.070\ V^2$
Racer	$A = 18$	$P = 0.045\ V^2$
Light roadster	$A = 18$	$P = 0.045\ V^2$
High truck	$A = 30$	$P = 0.075\ V^2$

Grade Resistance—In the former article, already referred to, this was shown to be very near 20 pounds per ton of car-weight per 1 per cent of grade. This figure is sufficiently correct for any probable grades, the percentage being based on the ratio of rise to horizontal distance.

Acceleration Resistance—This is seldom a factor in design unless for commercial passenger transportation, as, say, on a Fifth Avenue stage. The tractive force of the engine being nearly constant during acceleration, while the air resistance is steadily increasing (equation XXIII), the force available for acceleration is steadily decreasing and the car will accelerate most rapidly at the beginning of its trip. The relations can best be expressed by an expression including the effects of both air resistance and acceleration, thus:

$$F_a = 95.6\ \frac{V_2 - V_1}{t} + \frac{0.000833\ A}{T} \cdot \frac{V_2^3 - V_1^3}{V_2 - V_1}$$

$$\text{(alternately)} = \frac{V_2^2 - V_1^2}{V_2 - V_1} \cdot \left(\frac{23.33}{s} + \frac{0.000833\ A}{T} \right);$$

where F_a = the total constant tractive force available for accelerating and overcoming air resistance, in pounds;

V_2 = velocity finally attained in the time t seconds or the distance s feet;

V_1 = initial velocity in feet per second (= zero if the car starts from rest) in feet per second;

T = total weight of car in tons;

A = equivalent head-end area, in square feet.

As an example, let $V_1 = 0$, $F_a = 300$, $T = 1\frac{1}{2}$, $A = 30$ (maximum value), and let it be required to find the time and the distances in which the car will have attained a speed of 30 miles per hour = 43.9 feet per second. We have

$$300 = 95.6 \times \frac{43.9}{t} + \frac{0.025}{1.5} \cdot \frac{43.9 \times 43.9 \times 43.9}{43.9}$$

$$= \frac{4{,}200}{t} + 32.16$$

$$t = \frac{4{,}200}{267.84} = 15.7 \text{ seconds.}$$

Also,

$$300 = \frac{43.9 \times 43.9 \times 43.9}{43.9}\left(\frac{23.33}{s} + \frac{0.025}{1.5}\right)$$

$$= 1{,}920\left(\frac{23.33}{s} + 0.01667\right)$$

$$= \frac{44{,}700}{s} + 32,$$

$$s = \frac{44{,}700}{268} = 167 \text{ feet.}$$

Standard Resistance Specifications—There seems to be no good reason why certain standard conditions of grade, acceleration and speed should not be set for various types and weights of cars and thereafter employed in determining the necessary power equipment. As an example, let us assume the following:

TABLE VI

Type of car	Maximum speed,* miles per hour	Maximum grade, per cent.	Maximum speed required on grade, miles per hour	Acceleration	Weight of car, lbs.
Touring	60	13	30	Ignored	3300
Limousine	30	4	20	Ignored	3000
Racer	100	3†	60	Ignored	2400
Light roadster	35	6	25	Full speed in 1 minute	1300
High truck	25	3†	15	Full speed in 600 feet	5000

*On level road.

†Standard specifications might have to be changed to suit special local conditions.

From Table V and Fig. 5 we now tabulate the following resistance in pounds:

TABLE VII

Type of car	Head-end Area	Resist.* Due to max. speed	Resist.† Due to grade	Resist.‡ Due to speed on grade	Tl. Grade§ Resistance
Touring	30	270	429	68	497
Limousine	28	63	120	14	134
Racer	18	450	72	162	234
Light roadster	18	57	78	32	110
High truck	30	53	150	19	169

*$0.0025\ V_m^2 \times$ head-end area, where V_m is required maximum speed.

† (Weight ÷ 2,000)(20 × percentage of grade).

‡ $0.0025\ V_g^2 \times$ head-end area, where V_g is required speed on grade.

§ Sum of † and ‡.

Proportions

Power Requirements—From Table VII we may now select for each car the controlling (maximum) resistances as equivalent to the necessary wheel rim tractive power. This power is exerted through a distance equal to that traveled by the car; since horsepower equals

$$\frac{\text{force} \times \text{distance}}{33{,}000}$$

if we multiply a controlling resistance by the speed of the car in feet per minute we obtain

$$HP = \frac{R \times 5280\,V}{60 \times 33{,}000} = \frac{RV}{375.5} \qquad \text{(XXIV)}$$

while the tractive power is simply equal to controlling values of R, as designated by bold figures in Table VII. Using these values the horsepower necessary from equation (XXIV) becomes

TABLE VIII

Type of car	Traction power, lbs.	Speed, miles per hour	Horsepower
1. Touring	497	30	39.5
2. Limousine	134	20	7.1
3. Racer	450	100	119.0
4. Light roadster	110	25	7.8
5. High truck	169	15	6.7

In Case 1, however, the horsepower required at maximum speed on a level road is 43; so that this value must be used rather than 39.5.

Power Formulas—The two expressions from which cylinder dimensions will now be determined are given in equations (XIV) or (XV) (modified as suggested for piston speed), and (XIX) or (XX):

$$F = \frac{1.912\,Drc}{Nw} = \frac{Sd^2c}{192\,Nw}$$

$$HP = \frac{fS^e d^2 c}{24{,}100{,}000} = \frac{fd^2 scr^e}{145{,}200{,}000}$$

Using formulas in S, with $c = 9{,}000$, $w = 30$, $f = 1.85$, $e = 0.9$, these yield,

$$F = \frac{9{,}000\,d^2S}{192 \times 30\,N} = \frac{1.56\,d^2S}{N}$$

$$HP = \frac{1.85\,S^{0.9} \times 9{,}000\,d^2}{24{,}100{,}000} = \frac{S^{0.9}d^2}{1{,}450}$$

Allowing for transmission losses as in (XXI) and (XXII) and introducing the factor $\frac{fS^e}{S}$ in the expression for tractive power,

$$F = \frac{1.56\,fd^2S^e}{N} - g =; \qquad \text{(XXV)}$$

$$HP = \frac{F}{F+g}\left(\frac{S^{0.9}d^2}{1{,}450}\right) \qquad \text{(XXVI)}$$

These show that the tractive power varies conversely as the r.p.m. made by the wheels, and (very nearly) directly as the piston speed or r.p.m. of the engine. Since the wheel speed at any gear ratio is directly related to the piston speed, the tractive power is almost independent of either; but *it may be altered by changing the gears.* The horsepower, on the other hand, is directly related to the piston speed. By using gearing to reduce the rates of wheel speed to piston speed, *we may increase the tractive power and decrease the speed of the car without changing the speed or the horsepower of the engine;* or we may meet an adverse grade condition by lowering the speed.

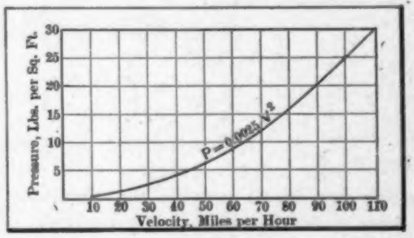


Fig. 5—Chart based upon pressure in pounds per square foot and velocity in miles per hour.

Acceleration—Considering the limiting acceleration conditions in Table VI, we have, by applying equations already given,

(a) $F_a = 95.6\,\frac{35}{60} + \frac{0.025}{0.65} \cdot \frac{35^3}{35} = 55.9 + 46.7 = 102.6$ lbs.;

(b) $F_a = \frac{25^3}{25} \cdot \left(\frac{23.33}{600} + \frac{0.025}{2.5}\right) = 625\,(0.036 + 0.01) = 28.75$ lbs.

Neither of these is a controlling value, and they may both be disregarded.

Summary of Requirements—These are now as follows:

TABLE IX

Type of car	On level track H.P.	On level track Tractive power	On grade H.P.	On grade Tractive power
1. Touring	43.0	270	39.5	497
2. Limousine	5.01	63	7.1	134
3. Racer	119.0	450	37.2	234
4. Light roadster	5.3	57	7.3	110
5. High truck	3.52	53	6.7	169

Touring Car—For this we must develop 43 horsepower and 270 lbs. tractive power at maximum speed (60 miles per hour) or 39.5 horsepower and 497 lbs. tractive power at 30 miles per hour. It is safe to say that 43 horsepower is necessary at either speed; so that the piston speed must not be reduced when running at a 30-mile rate, but the gear ratio must be doubled. This will also double the tractive power, which is very nearly

what is required. The value of N in equation (XXV) is found thus:

$$\frac{5{,}280\,V}{60} = \pi N \frac{w}{12} = 7.85\,N$$

$$N = 11.25\,V.$$

For $V = 60$, $N = 675$; for $V = 30$, $N = 337\frac{1}{2}$. Then, making $S = 1{,}000$, $g = 50$, $Sf^e \div S = \frac{86}{107.5} = 0.8$ (Fig. 4) equation (XXV) gives at 60 miles per hour, with *four cylinders,*

$$\frac{270 + 50}{4} = \frac{1.56 \times 0.926 \times 1{,}000\,d^2}{675}$$

$$80 = 2.13\,d^2$$

$$d^2 = 37.6$$

$$d = 6.1 \text{ inches}$$

And since $rs = 6\,S = 6000$, the engine may have a 6-inch stroke and run at 1000 r.p.m., or (better) an 8-inch stroke and run at 750 r.p.m. Equation (XXVI) gives, also,

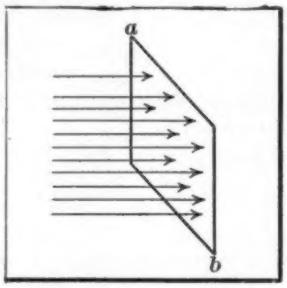


Fig. 6—Diagram constructed to illustrate resistances involving plain surfaces

$$\frac{43}{4} = \frac{270}{320}\left(\frac{501\,d^2}{1{,}450}\right) = 0.293\,d^2$$

$d^2 = 36.6$, $d = 6.1$ inches, as before.

Grade Condition—Equation (XXV) now yields

$$\frac{497 + 50}{4} = \frac{1.56 \times 0.926 \times 1{,}000\,d^2}{337.5}$$

$d^2 = 31.8$, and $d = 5.65$ inches;

or, from equation (XXVI),

$$\frac{39.5}{4} = \frac{497}{547}\left(\frac{501\,d^2}{1{,}450}\right) = 0.315\,d^2$$

$d^2 = 31.8$ and $d = 5.65$ inches.

A diameter of 6.1 inches is then suitable for either level or grade conditions to give the necessary horsepower or tractive power under the assumed resistances.

Conclusions.

Formulas—

Horsepower per cylinder, at the engine shaft, at maximum piston speed,

$$(1)\quad HP = \frac{d^2}{2.89} \text{ (see equation (XIX));}$$

Tractive power per cylinder referred to the engine shaft, at maximum piston speed,

$$(2)\quad F = 4.3\frac{d^2w}{V} \text{ lbs. (see equation (XXV));}$$

The corresponding values at the rim of the wheels, available for propulsion, may be about

$$(3)\quad F_o = 4.3\,\frac{d^2w}{V} - 50; \qquad (4)\quad HP = \frac{F_o\,d^2}{Fx\ \ 2.89}$$

(6) Resistance due to air = $0.0025\,AV^2$ lbs;

(7) Resistance due to grade = $0.01 \times$ per cent of grade $\times$ weight of car in tons;

(8) Horsepower corresponding to resistance = $((6) + (7))\,\frac{375.5}{V}$;

$$(8) = (4);$$

$$(6) + (7) = (3).$$

Remarks—The formulas apply only to four-cylinder engines, water cooled, and well operated. They disregard acceleration requirements. They may be employed to rate a motor by its tractive power as well as its horsepower. At other than maximum velocity conditions, the piston speed should be reduced as much as is possible under the imposed horsepower limit, the wheel speed being kept up by a proper gear reduction. If speeds on grades are so limited that the horsepower, rather than the tractive power, determines the cylinder dimensions and piston speed, and so that the horsepower is kept below the maximum required for level conditions, a more economical engine will be secured and the other conditions for harmony will be in better accord with the requirement.

Carbon Monoxide Stifles Efficiency

CALLING ATTENTION TO THE LOSS OF POWER AND LACK OF FUEL ECONOMY THAT COMES WITH POOR SCAVENGING AND OTHER THERMIC TROUBLES

NO amount of tinkering will help to bring up the efficiency of an internal combustion motor if the thermic relations are awry. In the past many attempts at making automobiles work properly were far too costly to be regarded as the product of an intelligent effort, and the so-called "tuning-up" process which has attended these efforts was really due to the floundering of men who were thrust in the breach, pending the coming of capable automobile engineers. When a motor fails to work for any reason, and a workman is assigned to the task of correcting the evils, if he has no knowledge of thermo-dynamics, he will tinker with the carbureter, take the magneto apart, put it together again, take a squint at the valve motion, perhaps walk around the automobile twice, and in other ways take up a vast amount of time at a cost of 60 cents an hour to the man who has to pay the bill, but he will not necessarily do the motor any great amount of good, and it might even be proper to add that the motor may be past fixing. This will be true if the motor is approximated by empirical methods of designing.

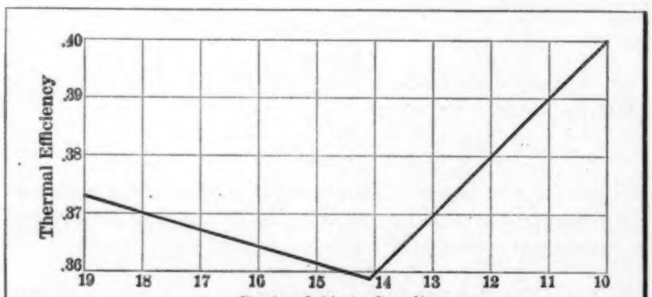


Fig. 1—Showing the thermal efficiency with varying percentages of air to gasoline under ideal conditions

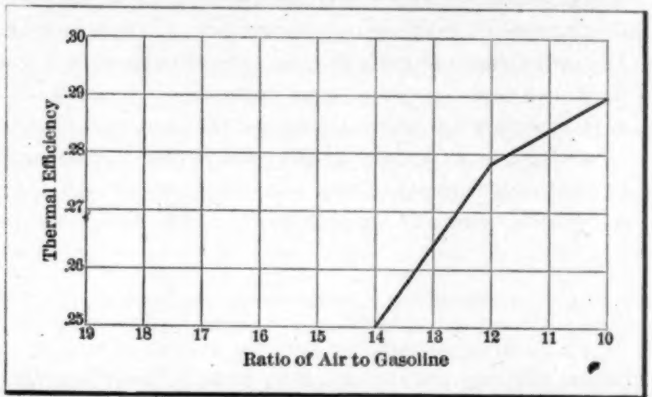


Fig. 2—Showing the thermal efficiency under conditions of some of the heat units not liberated, due to over-rich mixture

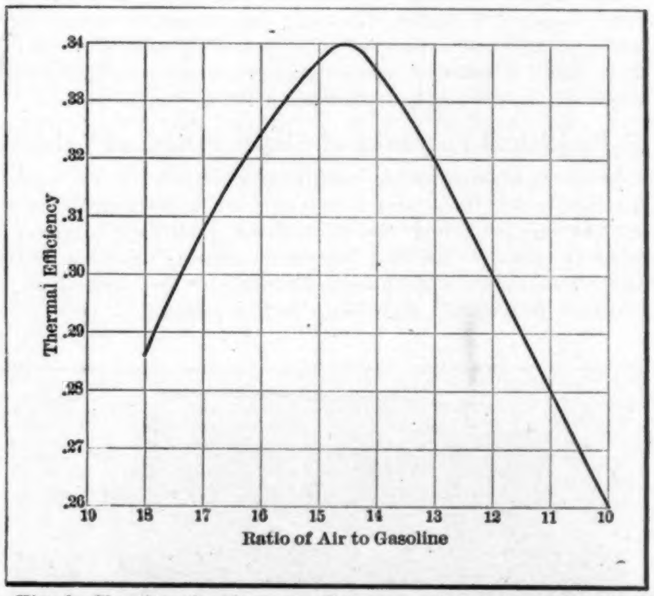


Fig. 3—Showing the thermal efficiency with varying percentages of air to gasoline determined by measuring the temperature of the exhaust

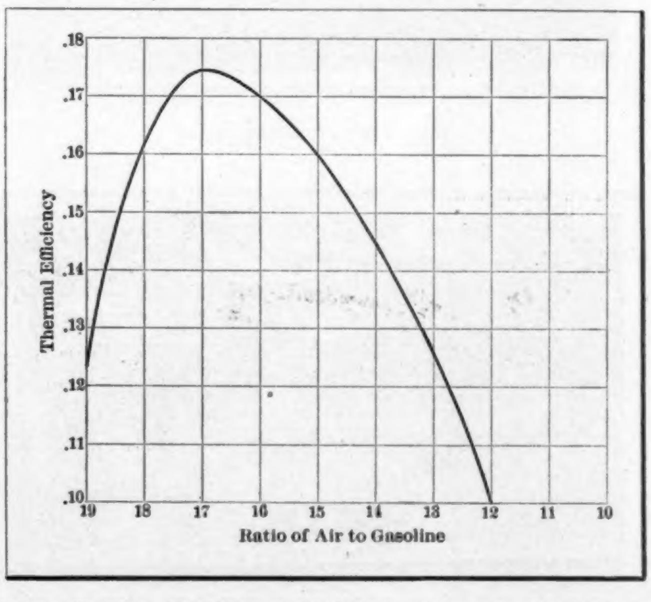


Fig. 4—Showing the thermal efficiency with varying percentages of air to gasoline under average conditions in practice

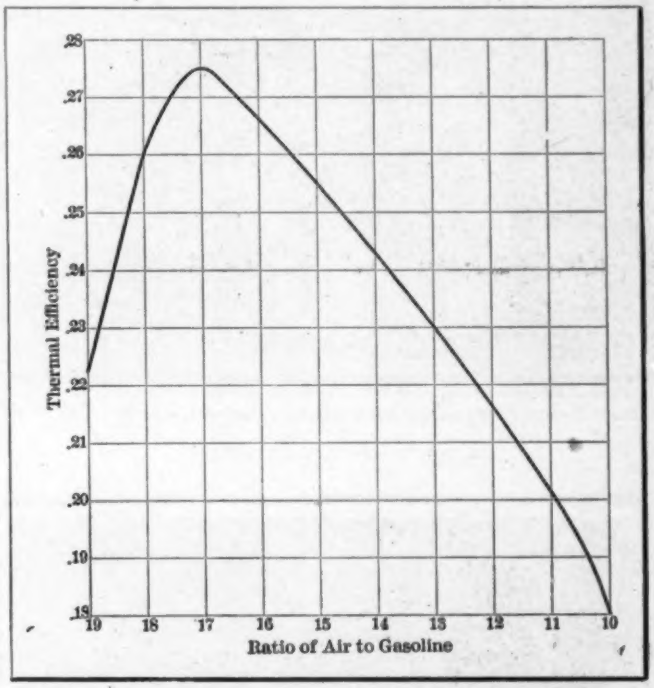


Fig. 5—Line showing the thermal efficiency with carrying percentages of air to gasoline

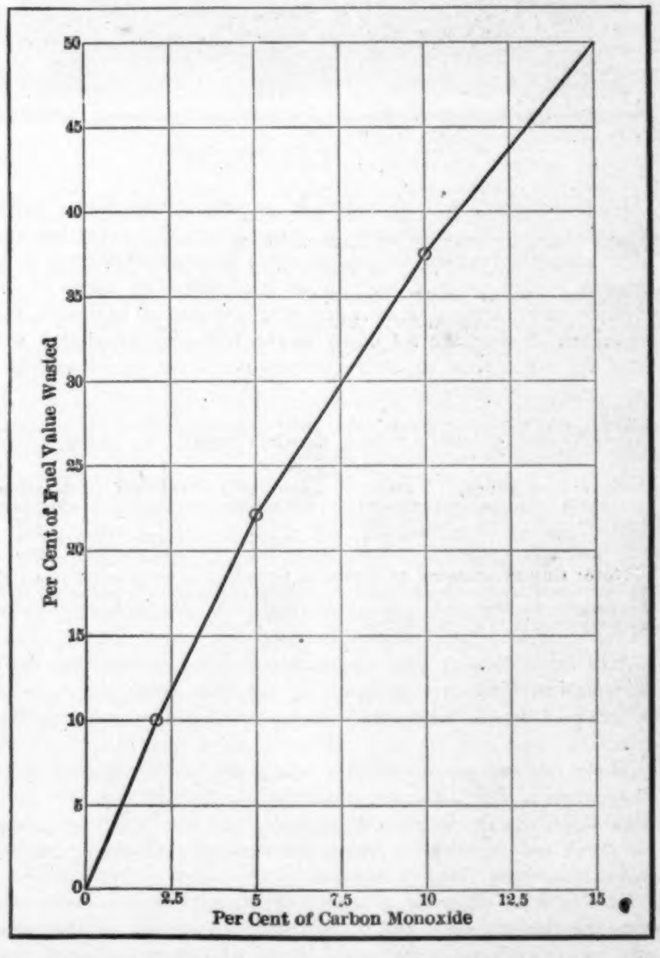
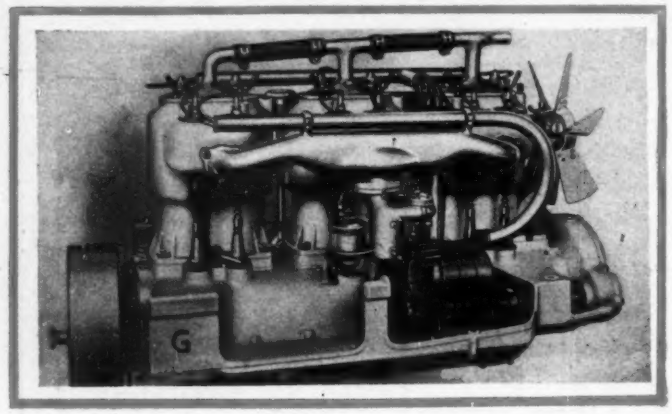
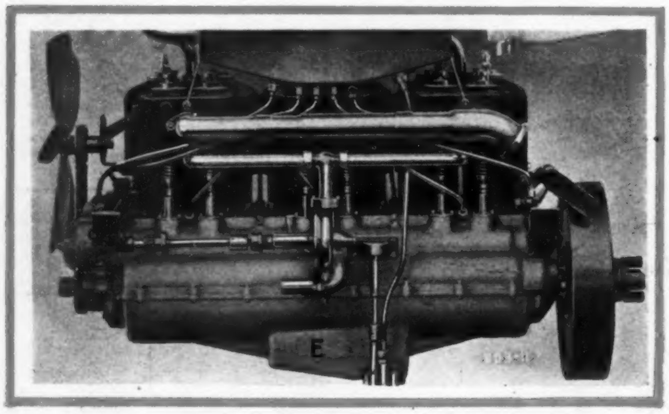


Fig. 6—Showing the heat units wasted for different percentages of carbon monoxide as found in the exhaust



Type 51 Six-Cylinder Lozier Motor



Pierce-Arrow Six-Cylinder Motor

Ideal efficiency, as it is called, in an Otto cycle motor, under the most favorable conditions of compression, can never be even approximately realized so long as there is any carbon monoxide present in the exhaust, and, in all probability, in view of the inferior conditions of scavenging that experience indicated, the relations, as they are set down in the following tabulation will hold for some time to come; perhaps until the cyclic sequence is changed considerably:

APPROXIMATE RELATIONS CONDITIONED BY THE OTTO CYCLE

Compression ratio	Gauge pressure	Ideal efficiency	Laboratory efficiency	Practical efficiency	Relative efficiency
4.71	86	0.367	0.275	0.175	0.749
4.35	77	0.354	0.272	0.172	0.769
3.92	68	0.337	0.263	0.163	0.780

Note: Gauge pressure is given in pounds per square inch, above the atmospheric pressure, and to obtain the absolute pressure it is necessary to add 14.7, which is taken to be the pressure of the atmosphere at the sea level.

An examination of this tabulation seems to indicate that there is a marked difference between the per cent. efficiency that can be realized under laboratory conditions and the practical efficiency.

There are two points to be kept in mind in estimating these differences. The laboratory values, as given, are the *very* highest obtainable in present practice, and the practical values set down are considerably above the average realization, excepting in the better class of motors.

The relative efficiency given in the table is taken to be the ratio of the efficiency under laboratory conditions to the ideal efficiency as given in the table. It is, of course, assumed that the comparison, in any given case, will be on a basis of equality

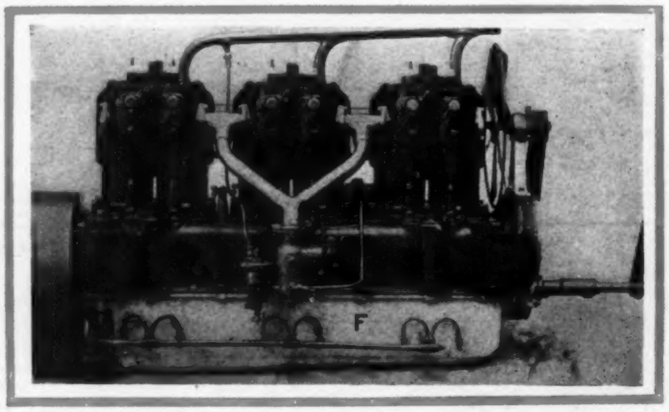
TYPES OF SIX-CYLINDER MOTORS, INCLUDING ALCO 6-60, CHADWICK, LOZIER 51, MATHESON, MITCHELL S, OLDSMOBILE LIMITED, HARTFORD, PREMIER 6-60, STEVENS-DURYEA AA AND Y, KLINEKAR, NANCE AND SEBRING. THE GAIN IN THE SUFFICIENTLY MARKED TO INDICATE THAT THE UTILITY OF AND IT IS ALSO APPARENT THAT THE POSITION THAT THIS WAY INFRINGING UPON THE LEGITIMATE SUPPORT THAT IS YEAR'S PRODUCT ALSO SHOWS CLEANER LINES THAN EVER

of fuel, compression ratio, piston speed, and adjustment of the functional units, as the carbureter, ignition, etc.

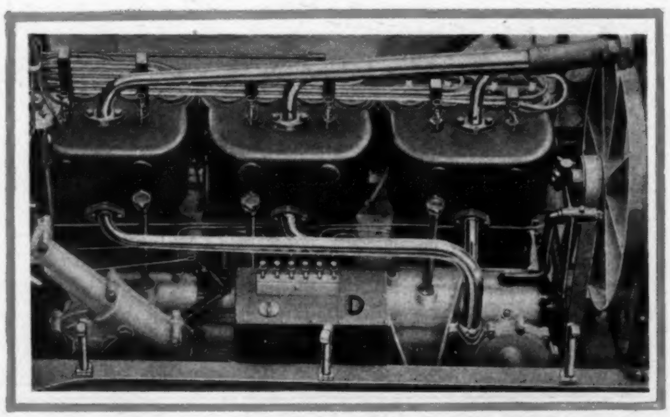
Just why there is likely to be a big difference between the practical efficiency and the laboratory result is better understood in view of the information given in the chart Fig. 6 showing the heat wasted for different percentages of carbon monoxide found in the exhaust. When it is considered that a 10 per cent. content of carbon monoxide means nearly 40 per cent. waste of the whole fuel value, it is not so difficult to realize that slight differences between motors under practical conditions will have a marked effect upon the power delivered.

Empirical Formulæ of Slight Practical Value

Not a few automobilists take a keen interest in the various formulæ which have been contrived from time to time for the purpose of predicting the horsepower ability of automobile types of motors. The best known formula of this class is that as devised by the "Mechanical Branch" of the Association of Licensed Automobile Manufacturers, as follows:



Six-Cylinder Premier Motor



Model "AA" Six-Cylinder Stevens-Duryea Motor

FRANKLIN D, KISSELKAR F-11 AND G-11, KNOX S, LOCOMOBILE M, (PALMER SINGER 6-60 AND 6-40, PEERLESS 32, PIERCE-ARROW, POPE-THOMAS K AND M, WINTON, PITTSBURGH-SIX, BELDEN, CAMERON, NUMBER OF SIX-CYLINDER MOTORS OVER LAST YEAR'S CROP IS A "SIX" IS BEING BETTER APPRECIATED THAN IN FORMER YEARS, TYPE OF MOTOR OCCUPIES IS SELF-SUPPORTING, WITHOUT IN ANY BEING EXTENDED TO THE REMAINING TYPES OF MOTORS. THE BEFORE.

Let,

d^2 = square of the bore of the cylinder in inches;

n = number of such cylinders working 4-cycle;

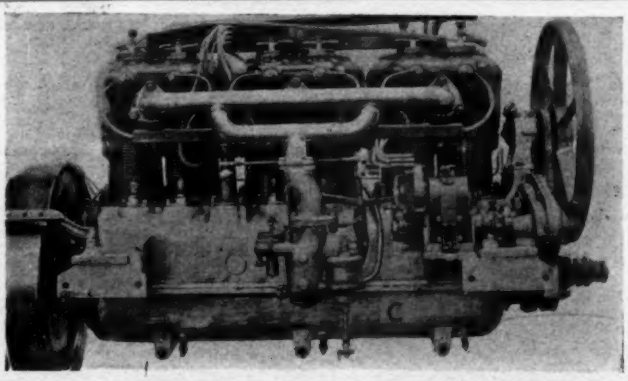
k = a constant = 2.5

When,

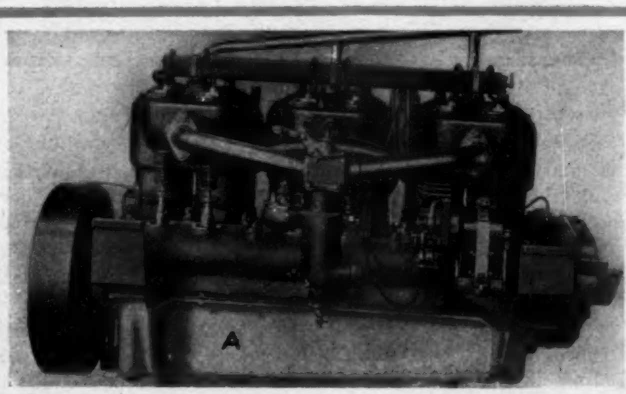
$$\text{H.P.} = \frac{d^2 \times n}{2.5} = \text{horsepower of the motor.}$$

This formula cannot possibly serve for any exact purpose, since it utterly fails to include any of the thermic relations, as the condition of scavenging, weight of fuel taken in, compression ratio, compression pressure, analysis of the exhaust products, heat absorbed by the water in the cooling jackets, back-pressure due to the use of a muffler, or as a result of tortuous transfer-ports, etc.

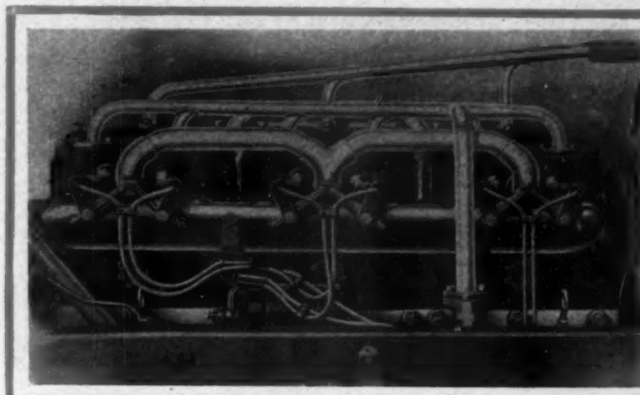
It is not believed that the committee of the "Mechanical Branch," when it agreed upon this formula, had any idea that it was more than a means of comparing motors in a simple mechanical way on a basis of 1,000 feet per minute of piston travel.



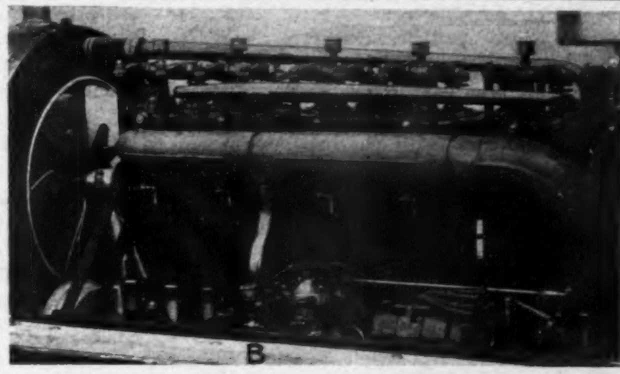
Model M Thomas Six-Cylinder Motor



Locomobile Six-Cylinder Motor



Winton Six-Cylinder Motor



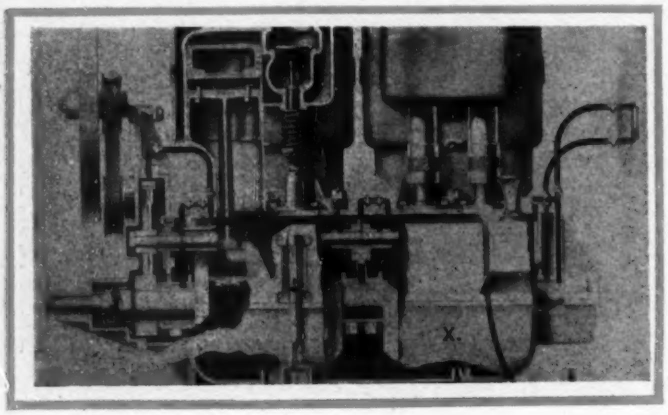
Matheson Six-Cylinder Motor

There is this to be said for the formula: were all motors equally well designed for the same work (which is not true), and maintained in the same state of perfection, the formula would then tell a like story for all; it would not, as a matter of fact, tell the actual horsepower of the motor excepting as a coincident, but it would be the means of deriving a horsepower constant.

It is only when users of automobiles begin to employ a formula such as this in an attempt to compare the several makes of motors that it becomes damaging; it would put a price upon inactivity; designers would fail to realize benefit for improvements. But this formula is no more an offender than any other empirical formula. On no account can it be shown that an empirical formula will tell, even within a reasonable percentage, the power that should be realized from a given motor, as compared with some other motor, unless both motors are precisely alike in every detail of design and construction.

There are two conditions that must be watched in a motor; they are: (a) the ratio of air to gasoline, and (b) the weight of mixture taken in by the motor in a given time and burned to carbonic acid and water; but if some of the fuel is incompletely burned it is necessary to subtract the loss so suffered, and it is also desirable to remember that even slight percentages of carbon monoxide, hydrogen and methane, in the exhaust, is a sign of a much enhanced diminution of power.

That there is a normal expectation is true, and, as a means for knowing the same, reference may be had to Fig. 1 of a chart which is plotted for showing the thermal efficiency with varying percentages of air to gasoline under ideal conditions. It is this high thermal efficiency that designers are striving for,



Mark 85 Columbia Motor

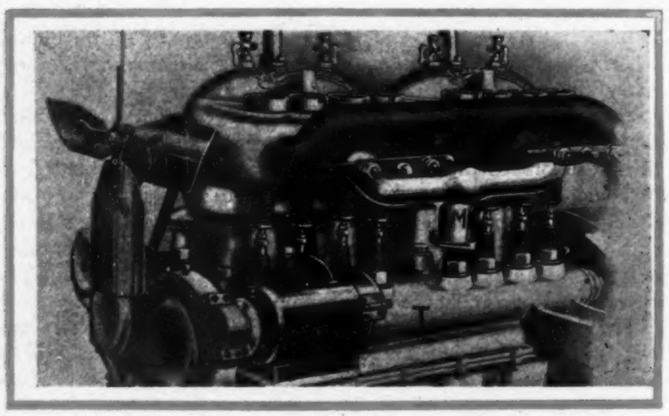
TYPES OF FOUR-CYLINDER MOTORS WITH CYLINDERS CAST IN BUICK, CARTERCAR M AND H, CASE, CHADWICK, CHALMERS 40, KISSEL KAR, KNOX, LOCOMOBILE, LOZIER, MARMON, MOON, NATIONAL, OAKLAND, OHIO, OLDSMOBILE, PACKARD, PREMIER, PULLMAN, RAINIER, REGAL, REO, ROYAL TOURIST, STODDARD-DAYTON, STUDEBAKER-GARFORD, THOMAS, VELIE, CORREJA, CRAWFORD, CUNNINGHAM, FIRESTONE-COLUMBUS, VELIE, G. J. G., SALTER, SHARP-ARROW, KOMET, TRAVELLER, ENGER 40, FRONTENAC, MARATHON, NANCE, SEBRING AND IN THE AUTOMOBILES FOR 1911, AND THE METHODS OF THE FUNCTIONING PROPERTIES ARE ON A PARTICULARLY

whether they know it or not. Under laboratory conditions it seems quite possible to now obtain some 75 per cent. of the ideal thermal efficiency, and in thus referring to it, it is equal to saying that the Otto cycle offers nothing more.

It would seem, under the best possible conditions as they at present obtain, the chart, Fig. 3, is offered as showing the thermal efficiency with varying percentages of air to gasoline as determined by measuring the temperature of the exhaust. It was pointed out by Professor W. Watson, in his Cantor Lectures, that the heat within the combustion chamber is so high that all means available for measuring it, and its variations, are futile—platinum wire is melted in this atmosphere. What Fig. 3 does show is that the highest temperature obtains when the ratio of air to gasoline is in the region of 14.7; this is also the normal expectation.

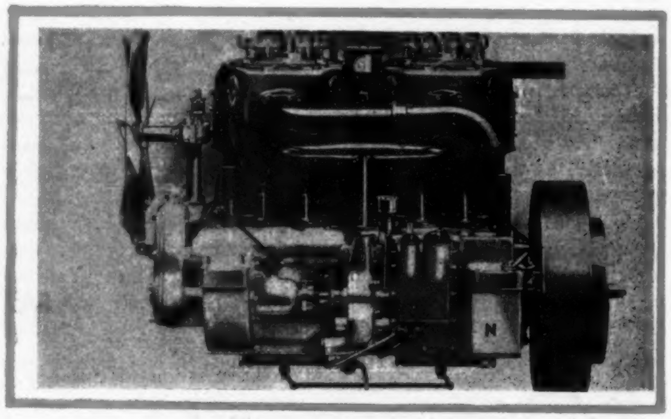
The thermal efficiency as calculated from data, taking the ratio of air to gasoline as richer than 14 to 1, is demonstrated in Fig. 2, showing the thermal efficiency under conditions of some of the heat not liberated due to over-rich mixture. The raise in the curve, despite the unbalancing of the mixture, is due to (a) the falling of the temperature caused by the presence of excess gasoline, thus reducing the losses to the water-jacket, and (b) an increase in the weight of mixture concomitant with the lowering of the temperature.

For laboratory results, it is more than likely that the chart, Fig. 5, showing the thermal efficiency with varying percentages of air to gasoline, presents an excellent view, remembering, of course, that it is too good to be true of motors of an indifferent design. This curve also indicates that the normal expectation is somewhat influenced; the highest thermal efficiency, instead of occurring at 14.7 of air to gasoline, takes place at

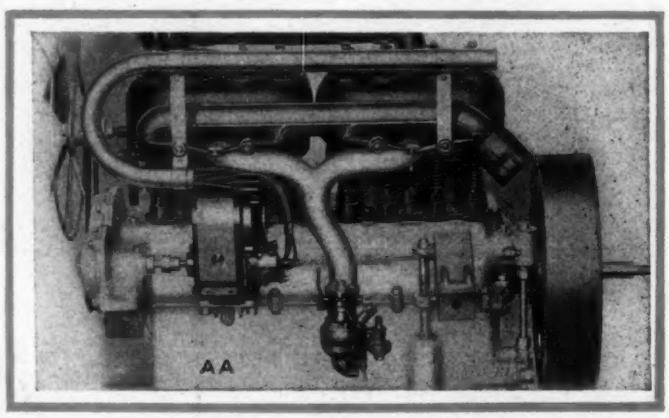


Four-Cylinder Twin Type Speedwell Motor

about 17.2, thus indicating, among other matter, that an excess of air over and above the theoretical right amount is desirable. This finding accords with good reasoning, and points to the need of better scavenging as a future improvement. To the average automobilist, practical result is of far-reaching interest, and, after all, it is the obtainable under practical conditions



Peerless Motor with Twin Cylinders



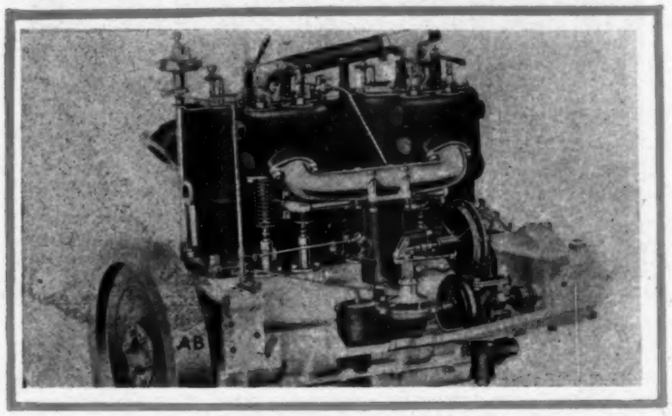
Regal Forty Motor with Twin Cylinders

that must be paid for. Best practice differs from the indifferent result that is frequently obtained, but it is useless to devote space to the recording of things that do not prosper. Fig. 4 has the virtue of showing the thermal efficiency with varying percentages of air to gasoline under good average conditions in practice. This curve clearly indicates that an excess of air is productive of economical results, and, to the man who desires a continuance of that stable performance, which is more nearly realized in the absence of over-heating, it is recommended that the supply of gasoline be maintained somewhat below the amount which will deliver maximum power in a given motor.

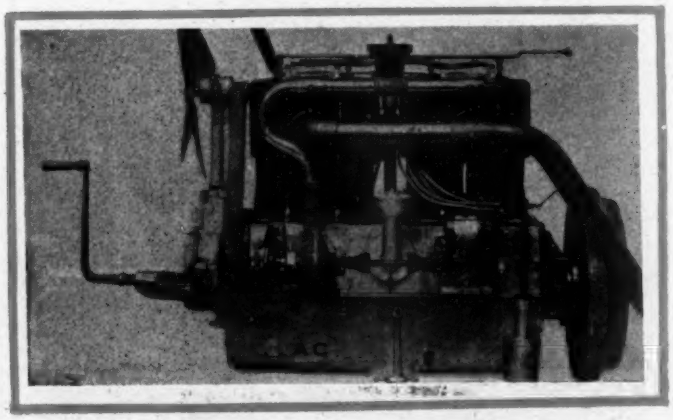
PAIRS, INCLUDING AMERICAN, AMPLEX, ALCO, ATLAS, AUTOCAR, COLUMBIA, CORBIN, HAYNES, HUPMOBILE, INTER-STATE, JACKSON, MATHESON, MAXWELL, MERCER, MIDLAND, MITCHELL, MOLINE, PALMER-SINGER, PEERLESS, PIERCE-ARROW, POPE-HARTFORD, SELDEN, SIMPLEX, SPEEDWELL, STEARNS, STEVENS-DURYEA, ABBOTT-DETROIT, ALPENA, ARBENZ, ATTERBURY, CARHARTT, FAL. CAR, HENRY, LION, PARRY, PATERSON, STAVER-CHICAGO, WILCOX, ZIMMERMAN, BELDEN, COLBURN, CINO, DORRIS, DE TAMBLE, HERRESHOFF. THIS TYPE OF MOTOR IS FULLY REPRESENTED CASTING THE CYLINDERS ARE NOW SO WELL ESTABLISHED THAT HIGH PLANE.

Time Testing Should Not Be Overlooked

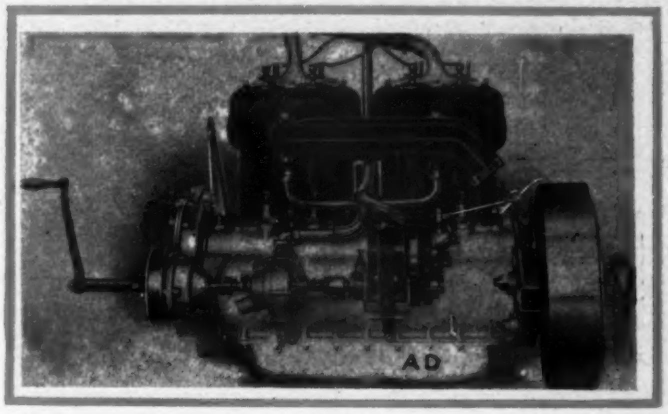
The great fault with all records of tests and investigations is reflected in the differences, as shown here, between laboratory and practical realizations. Any satisfaction that a user of an automobile is likely to experience will be due to practical result; if more power can be taken from a motor under laboratory manipulations, it is of small consequence to the user—the addition will not be for him. Certainly, the time may arrive when the user will benefit from laboratory work, and it is on this account that he should accept all authentic indications. To put up with the present and be hopeful of the future, is the difference between the laboratory and the machine on the road.



Twin Cylinder Packard Type of Motor


National Forty Twin Cylinder Motor

There is a connection between the automobile on the road and laboratory testing that should not be overlooked. When it is shown by a laboratory test that the power delivery may be increased by altering the ratio of air to gasoline, in all probability it will not be indicated by the test just what the attending variables are.



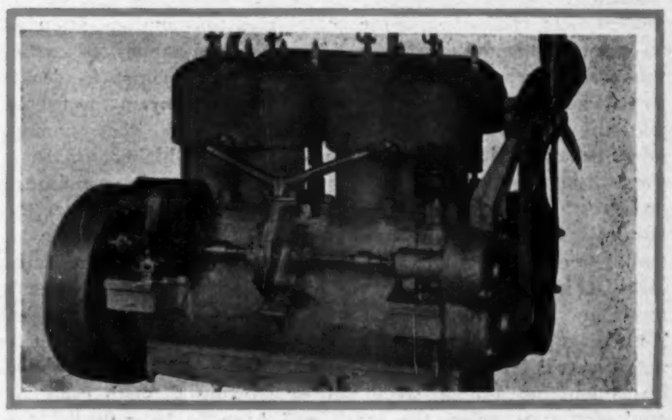
Marmon Thirty Twin Cylinder Motor

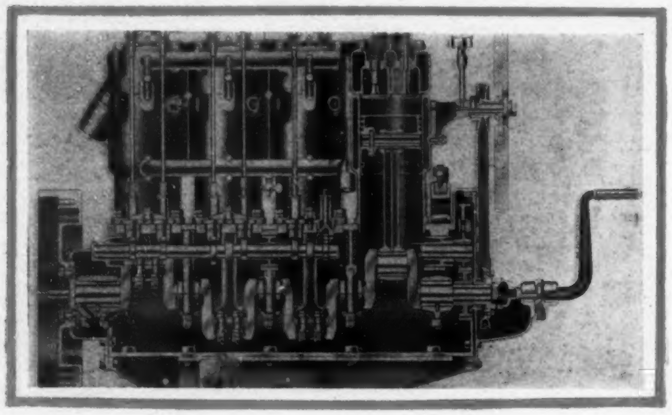
Coke Formations to Be Reckoned With

The laboratory test may not be conducted for a sufficient length of time to show all the results that might attend the practice of enriching the fuel, for illustration; time might be the missing link between more power and a considerable acquisition of coke in the combustion chamber of each cylinder of the motor. Coke is formed when carbon is heated to a point approximating 550 degrees centigrade in a hermetically sealed chamber, from which the air (a supply of oxygen) has been excluded. If some air is admitted, some of the carbon will be consumed, and the balance will form into coke. Ordinarily, it is the practice to make coke out of wood or coal; gasoline is too expensive (at $32 per ton) to employ in the manufacture of coke. Then, there is more carbon contained in certain forms of wood and coal than there is in gasoline. But gasoline is free to use in a coking process, and the mere fact that the carbon is combined in a liquid does not prevent its formation into coke if the conditions are right, and they will be if the amount of oxygen present is insufficient, as is the case in the combustion chamber of a motor whenever the mixture is over-enriched.

All remaining conditions, as the hermetically sealed chamber, the necessary heat, and a sufficiency of time, will be present in a motor, and, with these points uppermost, it remains for the automobilist, if he desires long-continued service rather than momentary bursts of power, to pinch off the supply of gasoline whenever the thermal relations point to over-heating.

In actual practice it is not difficult to determine what to do; It is known that a motor is prone to over-heat when it is running slow, especially on a retarded spark, and, for the best result


Velie Type of Twin Cylinder Motor



Four Cylinder Model R Knox Motor with Detachable Heads

in the long run, it is wise to so adjust the supply of gasoline that the motor will run as slowly as possible without heating up during the period of no work, even though it may be true that the power that can then be realized at the higher speeds will be considerably reduced, due to the lessening of the total weight of mixture taken in, despite the fact that the depression around the carbureter nozzle increases with the piston speed, thus increasing the flow of gasoline with the speed; but the adjustment of the auxiliary air-valve by the operator, while it compensates for all inequalities within practical limits, also has the effect of limiting the total weight of mixture to that which the motor is capable of assimilating, with the result, as previously intimated, that the power of the motor will be lower, at the higher speeds than it would be were it to be adjusted to aspirate more gasoline at the lower speeds—enough, in fine, to induce a condition of abnormal heating.

From what has been said, and in the face of the fact that the thermal efficiency of a motor, as shown by a laboratory test, may be nearly 28 per cent., it remains to be satisfied with even 10 per cent. less than this excellent value, in order not to induce the formation of carbon in the combustion chamber, understanding, of course, that any considerable deposit of carbon, together with silicon, etc. (a carbon residuum is likely to serve as the cement for the other foreign substances that are swept in with the air), will superinduce a condition of pre-ignition, although knocking will be an earlier manifestation.

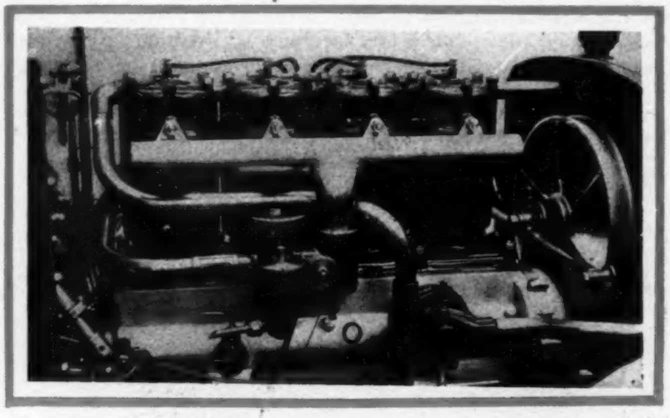
Motor Performance Will Be Relatively Soft

Running on a restricted supply of gasoline, in addition to the reducing effect it will have upon the power of the motor at the higher speeds, will also bring on a condition of "soft" performance; the life of the motor will be prolonged; silence will be more nearly realized, and the actual fuel consumption, attended by economies of lubrication, will be numbered among the expectations. It remains for the individual automobilist to decide as to whether or not he will put up with economy in the use of fuel and lubricating oil, lower depreciation, and silent running, all of which, at the cost of some power at the higher speeds of the motor, not forgetting, of course, that it is quite a nuisance to have the water in the cooling system boil away whenever the motor is allowed to run free on a retarded spark, as when an automobile is brought to a standstill at the curb, and the automobilist, instead of shutting the motor down, retards the spark and allows it to run.

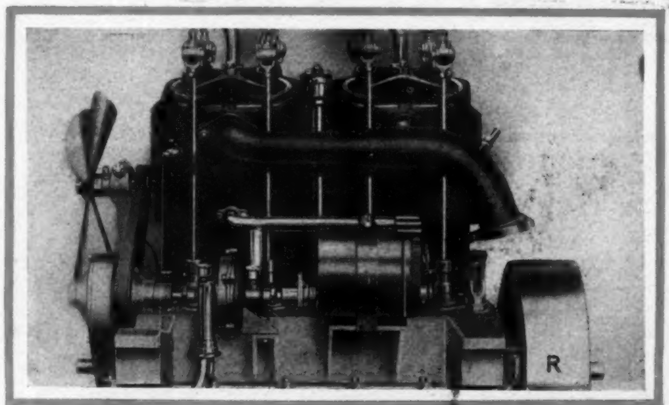
But even if it is preferred to shut the motor down when it is not in actual service, the fact remains that when the automobile is climbing up a long, steep hill, or plowing through sand, or mud, for even miles, the spark will have to be retarded for purposes of obtaining the requisite amount of power; the speed

UNUSUAL TYPES OF MOTORS INCLUDING THE AMPLEX, ATLAS, ELMORE, EVERITT, FRANKLIN, HUDSON, HUPMOBILE, JACKSON, WINTON, KRIT AND ONLY CAR. THE REFERENCE HERE TO ACTERISTICS THAT ARE DIFFERENT FROM NORMAL PRACTICE, CYLINDERS WITH INTEGRAL HEADS, WHEREAS THE KNOX THERE ARE NOT A GREAT NUMBER OF EXAMPLES OF THIS WOULD APPEAR THAT THE VARIOUS DESIGNERS, WITH THE BEATEN PATHS. TAKE THE CADILLAC TYPE OF CYLINDER WORKING OF THE COPPER WATER JACKET, THE FACT AMONG THE AMERICAN AUTOMOBILES THAT RESORT TO THIS

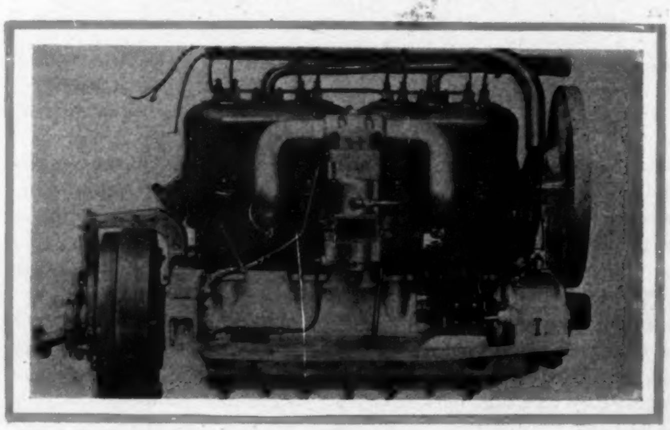
of the crankshaft will be considerably lowered, and the excess of gasoline complained of will do its fatal work—carbon will



Panhard Knight Valveless Motor



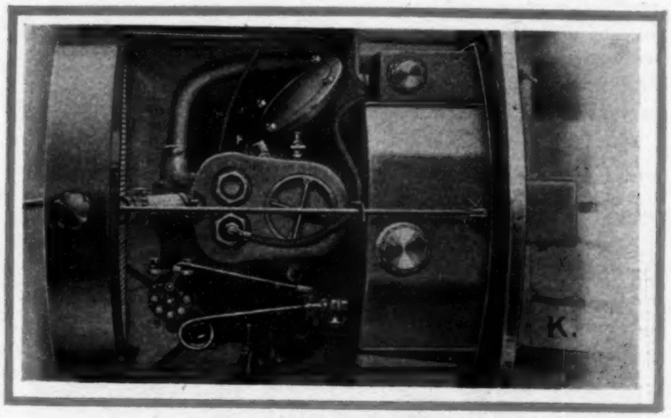
Stoddard-Dayton 20 with Valves in Head



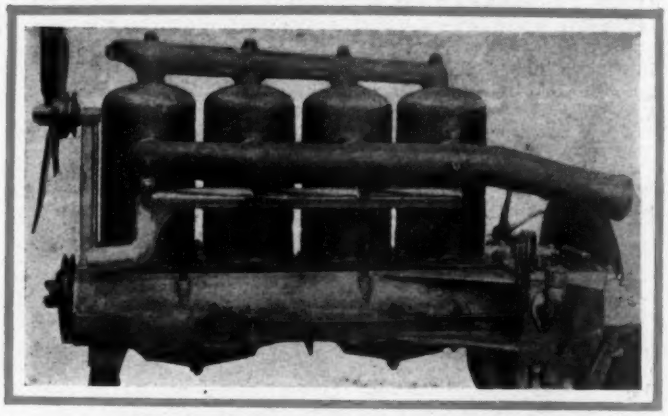
Four-Cylinder, Two-Cycle Amplex Motor

AUTOCAR, BRUSH, CADILLAC, CHADWICK, CHALMERS, CORBIN, KNOX, MATHESON, MAXWELL, MITCHELL, STODDARD-DAYTON, UNUSUAL TYPES OF MOTORS HAS FOR A FOUNDATION THE CHAR-AS, FOR ILLUSTRATION, IT IS THE USUAL CUSTOM TO CAST THE TYPE OF CYLINDERS IS DESIGNED WITH A SEPARABLE HEAD. SORT, AND, FROM AN INSPECTION OF THE SEVERAL LISTS, IT FEW EXCEPTIONS NOTED, FOLLOW ALONG MORE OR LESS CONSTRUCTION AS A BASIS FOR DISCUSSION; DESPITE THE WELL-REMAINS THAT THERE ARE BUT TWO DESIGNS OF RECORD CONSTRUCTION.

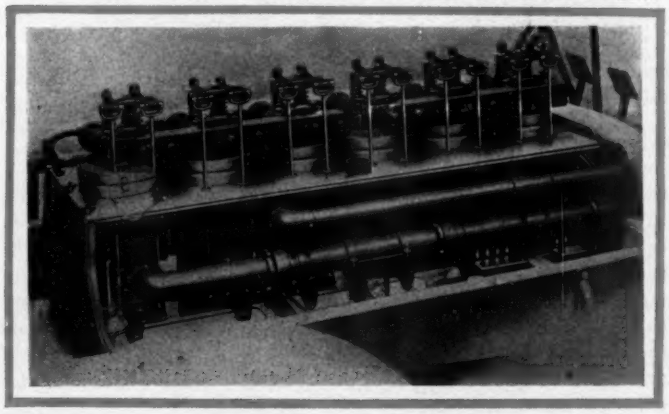
form in the combustion chamber, and over-heating will be the result. Strange to relate, even going down a long, steep grade



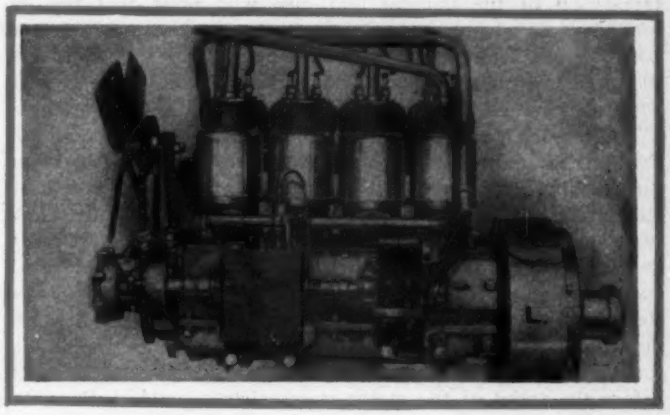
Single-Cylinder (Vertical) Brush Motor



Four-Cylinder, Two-Cycle Elmore Motor



Six-Cylinder Air-Cooled Franklin Motor



Four-Cylinder Cadillac Motor with Copper Jackets

will bring on the very condition that it is so desirable to abort; the motor will have to be run without load, and in order to prevent it from racing, it will have to be run on a retarded spark.

The "soft" performing motor has the advantage in other respects. When the clutch is disengaged, if the motor is of the "hard" performing sort, it will speed up greatly; if it does, and the speed is allowed to climb to heights, the secondary moments will increase as the velocity squared, and the life of the parts will be much affected.

From still another point of view it remains to attack the problem; the minimum of depreciation of a motor may be maintained when the total of the revolutions of the crankshaft, coupled with the minimizing of the maximum speed attained at any one time, more nearly accords with the distance the automobile makes, measuring the same in any convenient unit, as in miles per hour. There are two conditions under which a motor may be damaged, *i.e.* (a) when it is permitted to race, and (b) when it is slowed down by over-work.

When a motor is allowed to race the strains in the members will increase as the velocity squared, and if the motor is slowed down by over-work, the strains will increase in the inverse ratio of the speed. The first condition is expressed in the algebraic sense by the formula: $F = WV^2/2g$, and the second condition is exposed in the equation:

$$P = \frac{H.P. \times 33{,}000}{S \pi R S};$$

H.P. = horsepower; P = torque in pounds; R = radius of the crank-arm, and S = crankshaft speed in revolutions per minute.

The avoidance of over-working the motor, contrary to the not unusual method of feeding more gasoline, should be accomplished by a proper adjustment of the gear ratio. The motor for a given automobile, no matter how small its rating may be within reasonable limits, will maintain its power speed if the gear ratio is properly adjusted. In applying a given motor to a given chassis, the coefficient of stability of the motor must be studied, and the weight of the chassis must be counted upon ere the speed is fixed by the gear ratio. It is on this account that it is possible to employ a 10-horsepower motor to propel a 5-ton truck at a relatively low speed, and a 50-horsepower motor to propel a 1-ton passenger automobile, the difference being in the increased speed.

Reasoning Conflicts with Commercial Aspirations

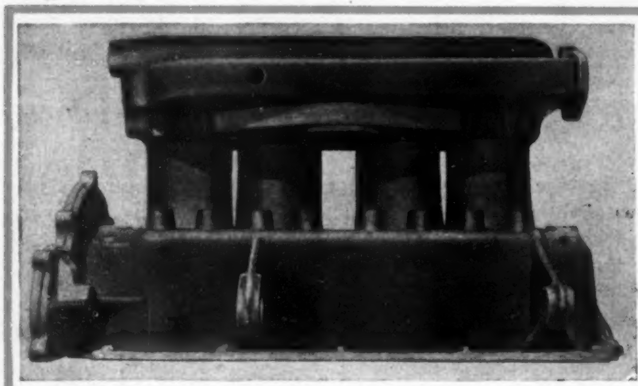
The power of reasoning, when the cost does not have to be counted, is noted for its piquancy; most men think clearly when other men pay the score. This is not strange, but it is the

foundation of the thought that men who must foot the bill should allow other men to do the thinking. **True principles are** not to be set aside merely because they run one into the necessity of hiring an accountant to keep track of the items—that is what accountants are for.

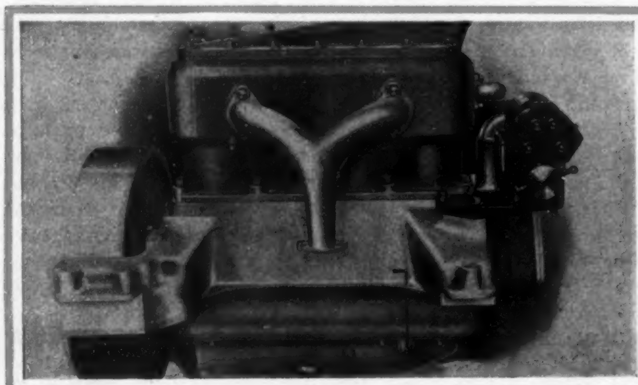
The true commercialism, when it is cleared of all debris, will show a clean pair of heels to the trick of over-loading the motor through the simple expedient of utilizing a low gear ratio. The automobilist who puts money into an automobile that will go fast, very fast, indeed, on a level hard road, with a relatively heavy chassis, or a small-powered motor in a moderately ballasted chassis, meets his Waterloo when he comes to a long, steep hill; the motor will be over-loaded; the automobilist will discover the fact after all the damage is done; his cue lies in the slowing down of the motor, and, according to custom, just before the speed of the motor is completely snubbed, the automobilist will slide into a lower gear. In this will be seen not a device for saving the members of the motor from life-reducing strains, but the strong desire, on the part of the automobilist, from having to get out and re-crank the motor.

True principles, when they are properly applied, will scarcely take the "industry," or lack of it, of the automobilist into account, at all events as a primary consideration, although it is plain that the very plan which serves well for the motor, also assures the automobilist that his motor will not be over-loaded; hence he need not harbor the fear that it will stop on a hill, or in the mud. But the automobilist will have to content himself with less speed on a level, hard road, or, if he desires speed, with safety, and low depreciation, he will have to pay out more money and get for it a larger motor for the given chassis.

When automobiles were first adapted to service they were



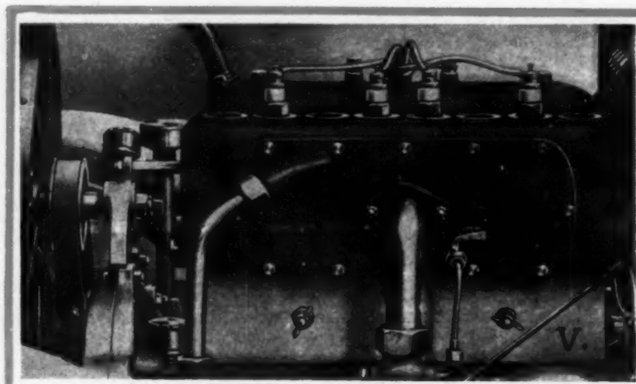
Everitt Thirty Motor, Showing Bloc Construction



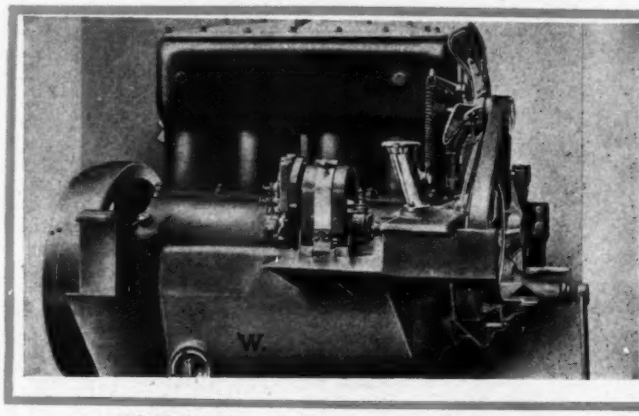
Hudson Bloc Type of Motor

TYPES OF MOTORS WITH BLOCK CYLINDERS, INCLUDING BRUSH, PALMER-SINGER, REGAL N. S. G. V., STEARNS 15-30, STODDARD-ROADER, SCHACHT, STAVER-CHICAGO, WARREN-DETROIT, THAT THE BLOCK TYPE OF MOTOR HAS GAINED FAVOR LAST YEAR WITH THOSE FOR 1911. THE BETTER FOUNDRY REQUIREMENTS, ARE ARGUMENTS IN FAVOR OF THIS TREND. OTHER TYPES OF CYLINDERS IS A MATTER THAT WILL NOT PRACTICE IS NOT WITHOUT LIMITATION.

looked upon as the toys of the rich, due to the fact that makers were unable to foresee that the time would come when the disorder known as "tinkeritis" would be eradicated. There still remains a considerable number of petty difficulties, which can only be underwritten with safety when the users of cars learn to let well enough alone. It may not be well understood, but the first thing that a young man does when he starts out on his career with the idea of becoming a marine engineer, for illus-



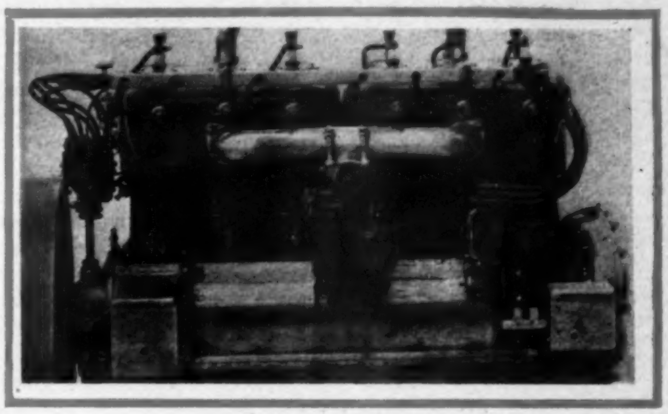
Showing Bloc Construction of the White Motor



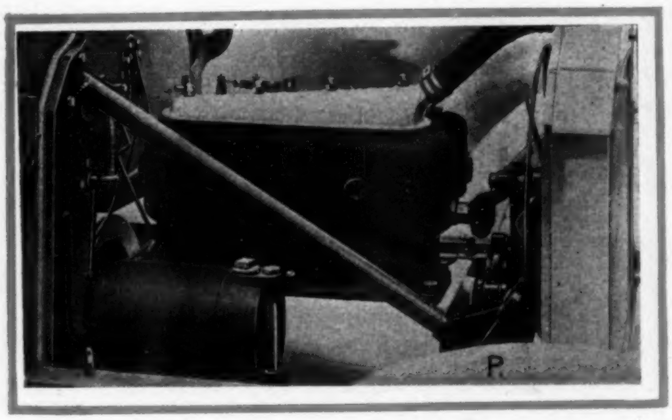
15-30 Bloc Type Stearns Motor

tration, is to acquire a commodious "squirt can," either by right of purchase or finding one that is enjoying a vacation, and equipping himself with a monkey-wrench besides. He exhibits rare industry, first by destroying everything that the monkey-wrench will fit, and then by wasting a vast quantity of lubricating oil, perhaps with the idea that he will be able to fix up the damage that he unconsciously does with the monkey-wrench under the impetus of uncontrolled brute strength. It is a dangerous thing to say to an automobilist, "let it alone," since, in all fairness, the time is sure to arrive when even the most sturdy

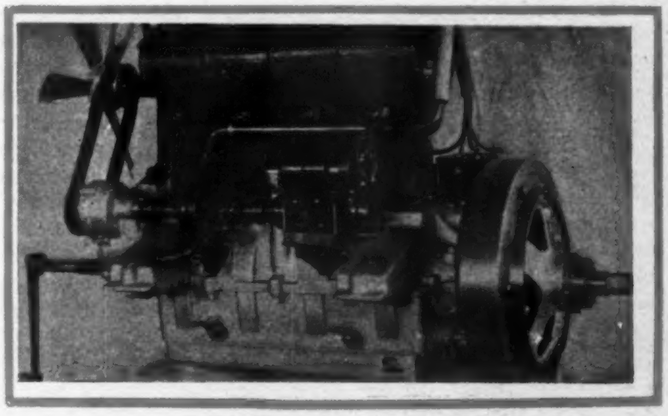
CHALMERS 30, FLANDERS 20, EVERITT 30, HUDSON 33, LAMBERT, DAYTON 20, WHITE, KLINE-KAR, BERGDOLL, HENRY, KRIT, PENN 30, DEAL, EMPIRE, HERRESHOFF, READING, AND WELCH-PONTIAC. WITHIN THE YEAR MAY BE SEEN BY COMPARING THE MOTORS OF WORK, DUE TO EXPERIENCE AND A GROWING KNOWLEDGE OF THE JUST WHERE THE LINE IS DRAWN BETWEEN THE BLOCK AND THE HAVE TO BE DISCUSSED UNTIL IT CAN BE SHOWN THAT THE



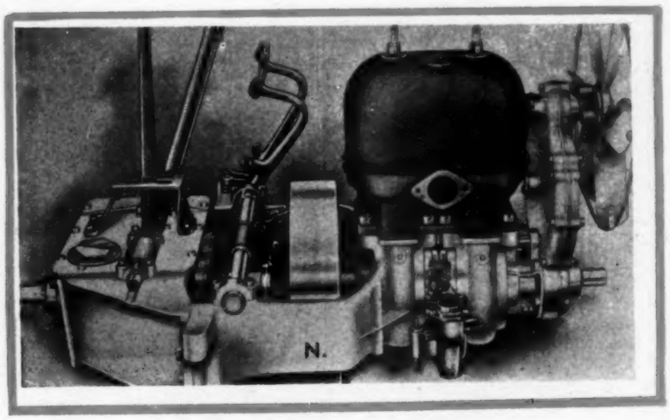
Six-Cylinder (Three-Cylinder Bloc) Palmer-Singer Motor



E-M-F (Flanders Twenty) Bloc Motor



Four-Cylinder Kline Motor, Bloc Construction



Two-Cylinder, Two-Cycle Atlas Motor

mechanism will need a little attention of a timely nature.

There is just a little danger that the desire for noiseless performance in motors is leading to a disorder which it is not difficult to trace to the strangling effect of a muffler which is noiseless because it will not let either the products of combustion or the noise out. It is useless to continue to discuss the questions of scavenging, and to point out how detrimental they are to good performance if the exhaust products of combustion are corked in by a most efficacious form of stopper which is tolerated because it is termed a muffler.

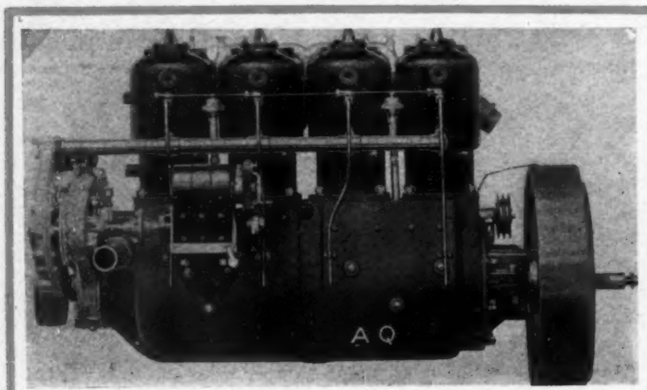
Lubrication for Motors

DEALING WITH THE PROBLEMS OF MOTOR LUBRICATION, SHOWING HOW THE PRESSURE VARIES AND THE EFFICACY OF THE SEVERAL PLANS IN VOGUE

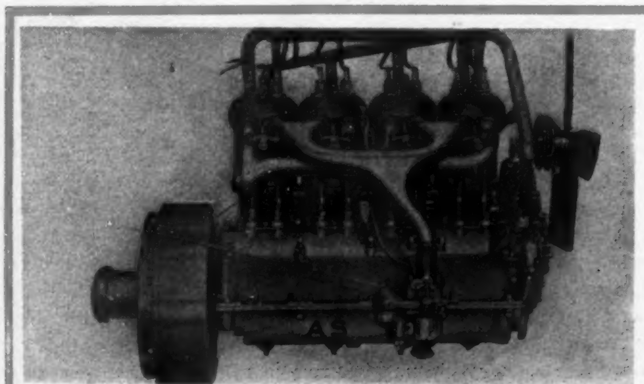
THE modern theory of lubrication is the theory of the oil film. The old ideal of a coefficient of friction gives place to the more suggestive theory that the resistance to motion is due to the shearing of a film of oil, which more or less completely prevents metallic contact and abrasion. The importance of the film is shown by considering that the resistance of a fully lubricated surface may be only one per cent. of a similarly loaded surface in which an oil film is not maintained. Resistance to shearing depends upon the viscosity of the lubricant, thickness of the film, and the area of film in shear. The temperature of the film may alter its viscosity; the extent of the film may not be equal to the extent of the bearing; the thickness of the film may not be such as to entirely prevent abrasion, and the clearance in the bearing may be irregularly distributed and inaccurate, and similar disturbances may be created by bad alignment of the shaft or its springiness, so it is not possible to entirely solve the problem. As usual in engineering, theory may direct or explain practice, but experience must determine it. Certain positive conclusions, however, may be taken as established, viz.:

(a) The resistance decreases with the thickness of the film.
(b) The resistance increases with the viscosity of the lubricant very materially.
(c) The point of nearest approach is approximately 90 degrees from the line of load.
(d) The points of maximum and minimum oil film pressure are approximately at equal distances from the point of nearest approach.
(e) As the speed increases the points of maximum and minimum oil pressure get farther and farther apart, till at very great speeds they are in the line of load.
(f) As the speed increases the eccentricity of the oil film becomes less.
(g) The concentric position is the one of least resistance.
(h) Oil should be supplied at a point where the supply pressure is greater than the film pressure.
(i) The loading for a given speed must not exceed a certain limit at which the oil film is broken.
(j) This limit may be increased by lengthening the bearing, so increasing the cooling influence on the bearing.
(k) Oil grooves wrongly placed may destroy continuity of the film.
(l) A motion of pure rotation produces automatic maintenance of the film, provided the supply is adequate.
(m) The temperature varies throughout the bearing, the highest temperature being at the point where the film is thinnest.

Further, in the case of a reciprocating load we know that a such a load, irrespective of rotation, produces automatic lubrication, and that heavier mean loads can be supported if the direction of load is reversed, because the lubricant is more vigor-

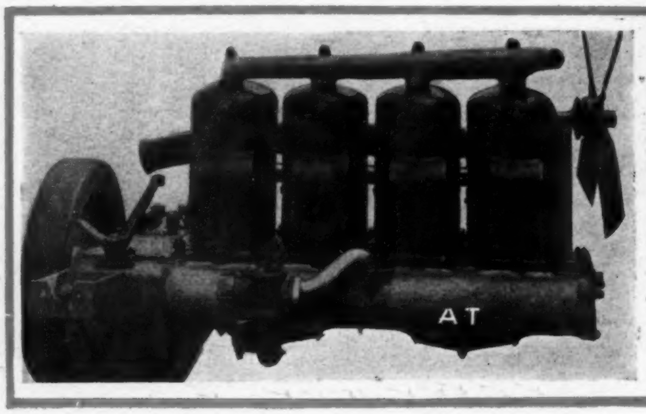


Rambler Motor with Individual Cylinders, Showing Magneto

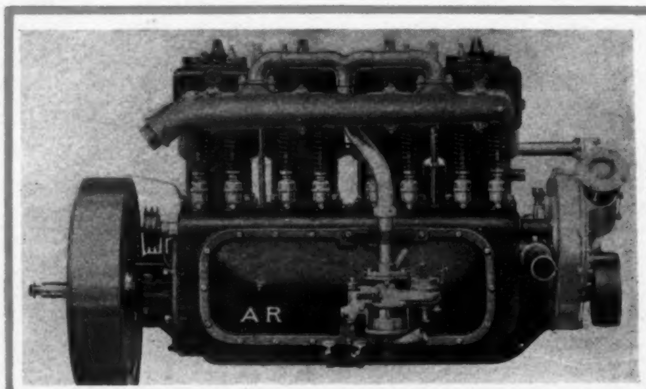


Cadillac Thirty Motor with Copper Jacketed Individual Cylinders

TYPES OF MOTORS WITH INDEPENDENT CYLINDERS, INCLUDING GLIDE, JACKSON, KNOX, LAMBERT, McINTYRE, MAXWELL, ONLY CAR, LUVERNE, PITTSBURGH SIX, SCHLOSSER, BERKSHIRE, CLARK, CAMERON, GREAT WESTERN, FULLER, THIS FORM OF CYLINDER CASTING HAS BEEN POPULAR MOTOR IS, OF COURSE, A LITTLE LONGER; THIS HAS THE BEARINGS, AND THE NECESSITY FOR THEM GROWS IN ABOUT THE FOUNDRY WORK THE CYLINDER CASTING IS ATTENDED TAKE VERY KINDLY TO.



Elmore Two-Cycle Motor with Individual Cylinders



Rambler Motor with Individual Cylinders, Showing Carbureter.

ously sucked in, and the retardation of surfaces approaching one another normally increases very rapidly as the film becomes thinner.

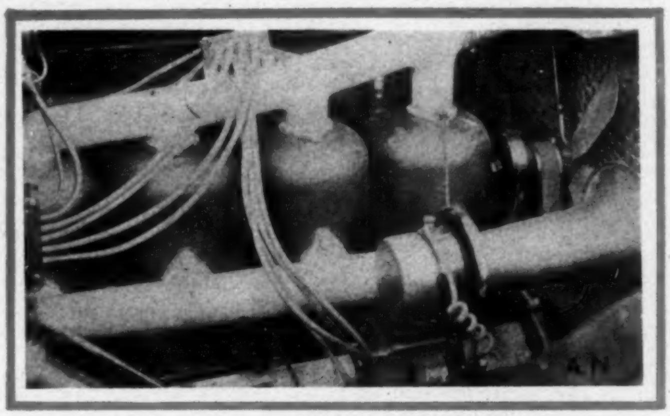
Generally speaking, failure of lubrication is caused by rupture of the film due either to inadequate supply of lubricant; reduction of the viscosity arising from excessive heating, either general or local; badly placed oil grooves; overloading; grit, or to impurities, such as water, reducing the film-forming quality of the oil.

Assuming that the bearings are not overloaded, that system of lubrication will be best which best ensures that other causes of failure shall not occur.

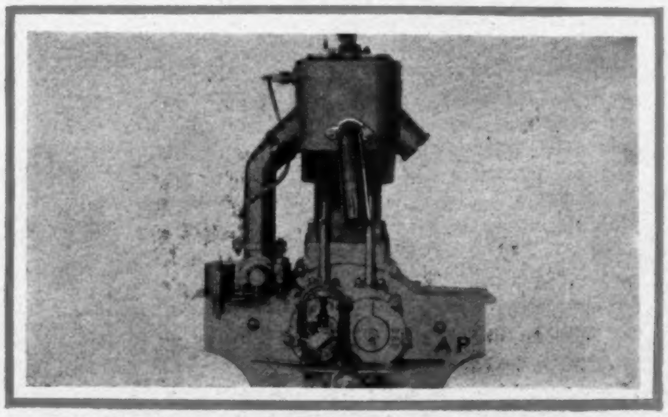
For high-speed steam-engines positive lubrication has been demonstrated to be ideal, and it is preferred by many designers of motor car engines. Various splash and gravity systems have been very carefully designed and worked out for car motors, and the success attained by them has been great.

Good results occur in a steadily loaded bearing, owing to the copious supply preventing excessive local heating of the film,

APPERSON, CADILLAC, CARTERCAR, CORBIN, ELMORE, FRANKLIN, OVERLAND, PULLMAN, THOMAS, ATTERBURY, LEXINGTON, METZ, STERLING, A. B. C., GREAT SMITH, AUBURN, ADAMS-FARWELL, GROUT, HALLADAY, KENMORE, KLINE KAR AND RIDER-LEWIS, AMONG A CERTAIN CLASS OF DESIGNERS FROM THE START. THE ADVANTAGE OF ALLOWING FOR A LONGER LENGTH OF MAIN THE SAME RATIO SINCE THE CRANKSHAFT MUST BE LONGER. IN WITH MUCH CERTAINTY, AND THIS IS A POINT THAT DESIGNERS



Overland Forty Individual Cylinder Motor



Model A, Only Car Motor, with a Long Stroke

leading to rupture. This is borne out by the experience that an engine with forced lubrication takes longer "run in" than one with splash or gravity supply, and further that its bearings take longer to take up a high polish. The benefits of forced lubrication are best realized with a circumferential groove, which enables heavy loads to be taken at high speeds.

Its rapid adaptability to various conditions and its positive maintenance of the all-important oil film are points in favor of positive lubrication. Splash and gravity systems require elaborate oil grooves, troughs and oil ways. With positive lubrication it is usual to provide a circumferential groove to supply oil at whatever point the minimum film pressure exists. Where more circulation is required, one or more horizontal grooves are cut in the bearing at suitable points, forming practically an oil pad, and also by increasing the circulation, having an important cooling effect on the bearing.

Some makers apply positive lubrication to main bearings only, and others to main bearings and crankpins; others carry it to the gudgeon pin, and in some cases it is also carried outside to details of the transmission.

For oiling the gudgeon pins, which are heavily loaded and have comparatively small reciprocating motion, much is to be said in favor of positive feed. There is a tendency for oil to "cake" and often carbonize on the crank case side of the piston head, and the drip system usually arranged for with splash lubrication may sometimes be a source of trouble, carbonized oil and carbon dropping into the oil ways, and causing wear or clogging of the oil hole. The oil is heated by the piston, and may be very hot and thin when it reaches its point of application.

In forced lubrication it is the usual practice to arrange baffles to prevent excessive oil being carried up the piston trunks. An adequate supply of oil to the gudgeon pins often leads to excessive lubrication of the pistons, and subsequent trouble with cylinders, valves and ignition.

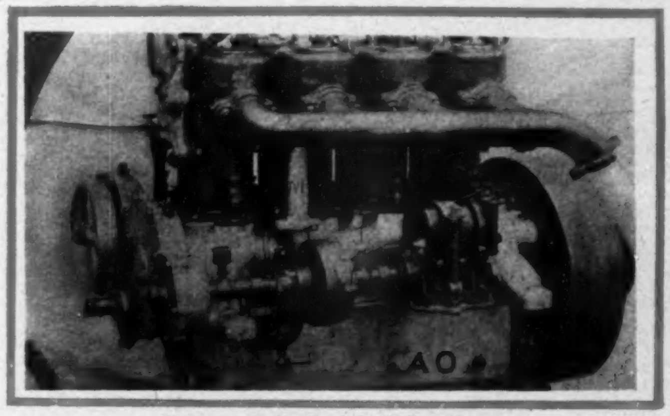
To prevent the efflux of oil from the main bearings in engines it is customary to use properly designed end plates, with baffles or thrower rings on the shaft.

In designing a forced lubrication system, the following points are kept in mind: A pump of ample size, with good big suction and delivery pipes. A good rule is to make the discharge from the pump at full speed depend upon the total clearance. Thus, with a plunger pump, if the volume swept out per minute on the discharge stroke be V, and the sum of the peripheries of all bearings at each discharge point be P, then $V = 8 \times P$ is a good value.

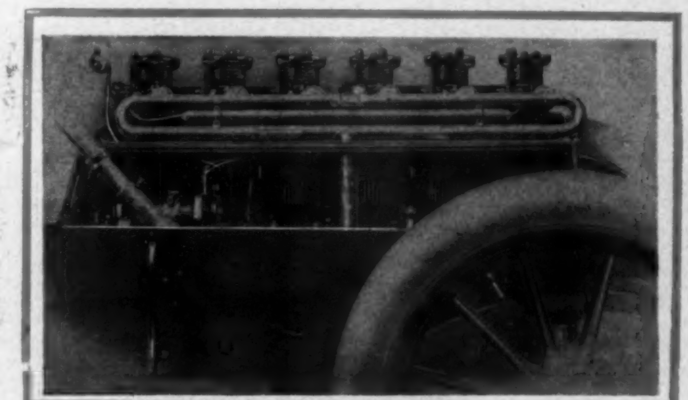
For the main delivery pipe, if B be its bore, take $B = \frac{P}{480}$.

Another point which makes it necessary to have an ample pump is that, due to centrifugal and inertia effects on the oil in the moving parts, variations in pressure occur beyond those due to fluid friction and escape at clearances.

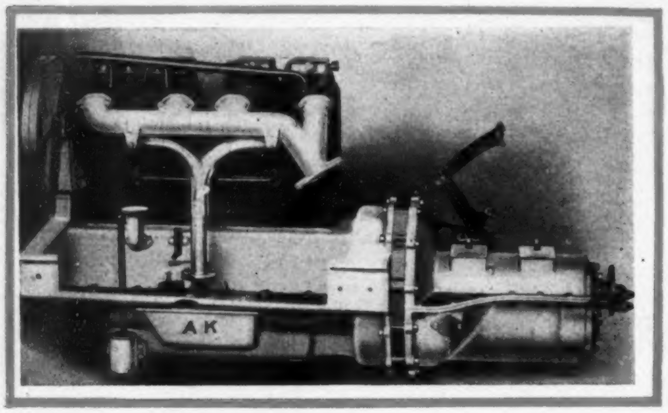
Oil pumps of various types are used, the most common being



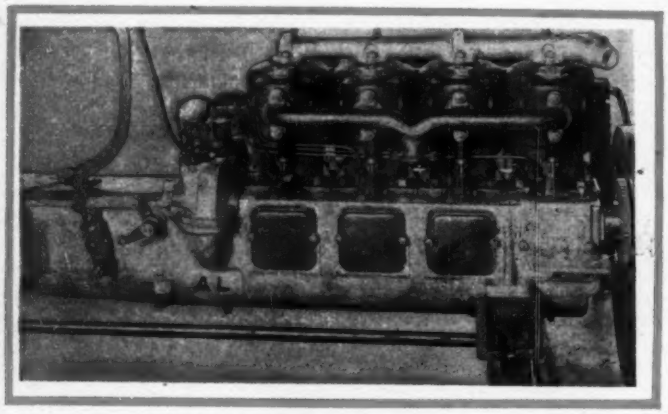
Pullman Individual Cylinder Motor



Air-Jacketed Individual Cylinder Franklin Motor



Cunningham Unit Power Plant



Maxwell Type of Unit Power Plant

the plunger, gear, and vane types. The first is the most positive. The second is good, and lends itself to simplicity of design. The third acts as well for moderate pressures. The result depends upon the character of workmanship of the pump used. The great question is to have the pump strong enough, in view of the fact that it is usually rather diminutive.

Characteristic Performance of Bearings and Pumps

A good understanding of the requirement from the point of view of pumps, or other means for supplying lubricants to bearings may be obtained by inspecting the diagrams as here reproduced, originally appearing in an article on forced lubrication which ran in THE AUTOMOBILE in an explanation of some experiments which were made by R. K. Morcom. Quite a number of the ideas that were enlarged upon on this occasion are suitable for use in illustrating principles of the broad question of lubrication, although as the diagrams first appeared they were so limited in scope that they were only applicable to the explanation of the phenomena of forced lubrication.

Referring to Fig. 1 and to (A) showing diagrams taken of the oil pressure at various points, in a test with a load pressure of 24 pounds per square inch. The index to the curves is as follows:

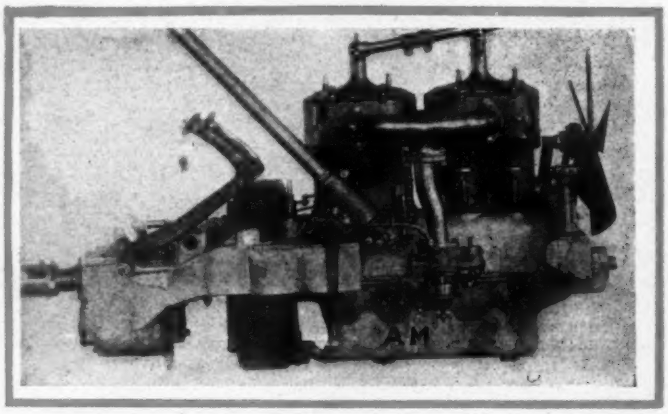
A. 500 r.p.m. 20 lbs. per sq. in. oil pressure.
B. 1,000 r.p.m. 20 lbs. per sq. in. oil pressure.
C. 1,000 r.p.m. 20 lbs. per sq. in. oil pressure.
D. 1,000 r.p.m. 40 lbs. per sq. in. oil pressure.
E. 500 r.p.m. 40 lbs. per sq. in oil pressure.
F. 1,000 r.p.m. 40 lbs. per sq. in. oil pressure.
G. 660 r.p.m. 20 lbs. per sq. in. oil pressure.

Referring to (B) Fig. 1, there are three curves of pressure,

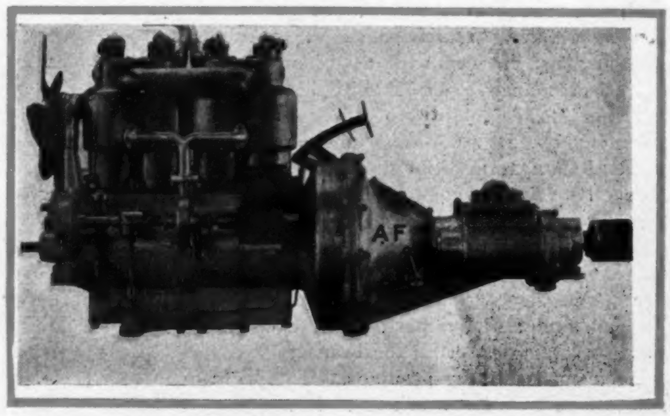
TYPES OF POWER UNITS, INCLUDING ATLAS, CHALMERS, HAYNES, MOLINE, STEVENS-DURYEA, ABBOTT-DETROIT, CUNNINGHAM, NUMBERS ENORMOUSLY WITHIN THE YEAR AND IT LOOKS BE ONE OF THE PERMANENT FEATURES OF STANDARDIZED PRACTICE TO LIMIT THE UNIT POWER PLANT DESIGNS TO BECAUSE OF ITS COMPACTNESS. THE IDEA OF HAVING THE THE MOTOR IS ATTRACTIVE TO THE MAN WHO KNOWS UPON THE CARE THAT HE BESTOWS UPON A SINGLE UNIT.

which will be more clearly understood if the reader will glance at the diagram of the crankshaft below. A study of these diagrams will show how the pressure goes up and down during the rotation of the crankshaft, changing with the cyclic relations, being a maximum during the explosion and subsequent performance of the power stroke, reaching well above 1,200 pounds per square inch at certain points in the revolution. Such pressures would be quite out of the question were it not for the fortunate circumstance that they are not constant, and, while it is assured that the lubricating oil will be squeezed out during the time of these high pressures, it goes in again, if the supply is adequate and under sufficient pressure, when the pressure is lowered, so that oil can cushion the succeeding pressure period.

While the question is up it will be well to consider the approximate speed of running that must be tolerated in motor work. This is brought out in (C) Fig. 1. The exact speed of rubbing of the gudgeon pin surface will not be the same in all motors, but the data of this particular motor is given in the illustration and it will be feasible to compare this performance with other cases if it is desired to do so.



Haynes Model 19 Unit Power Plant

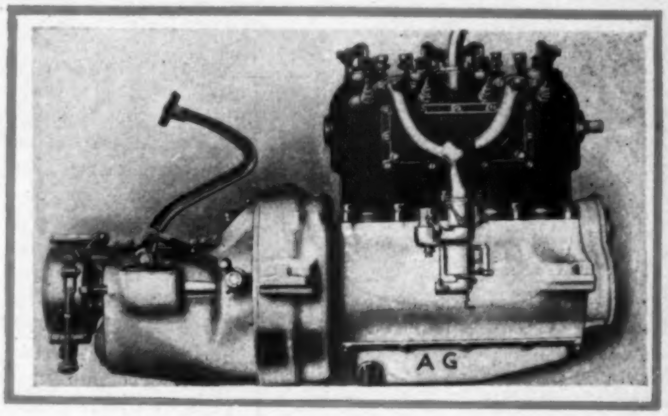


Lion Unit, Power Plant Construction

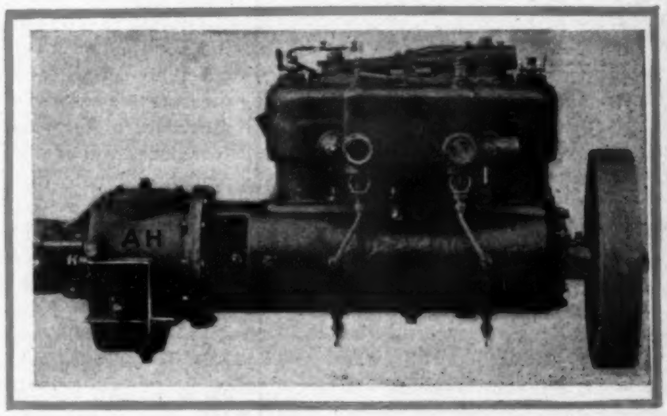
HUDSON, HUPMOBILE, JACKSON, KNOX, LAMBERT, MAXWELL, KRIT, SCHACHT. UNIT POWER PLANTS HAVE INCREASED IN AS IF THIS FORM OF MOTOR AND TRANSMISSION COMBINED IS TO DESIGNS OF THE FUTURE AUTOMOBILES. TRUE, IT IS THE MOTORS OF A CERTAIN POWER, AND CERTAINLY IT IS ATTRACTIVE CLUTCH AND TRANSMISSION WITHIN THE SAME HOUSING AS AUTOMOBILING; IT ASSURES HIM THAT HIS SUCCESS DEPENDS

The question of the pressure in pounds per square inch as it relates to the total pressure in pounds is handled in (D) of the same figure. In view of the fact that the projected area of a bearing is more or less an unknown quantity, due to the fact that, while it should be equal to the diameter of the bearing multiplied by the length, there is little assurance that the contact will be equally perfect for the whole length, it is impossible to state that the pressure around the bearing will be on a certain number of degrees of arc. This figure expresses the thought that there is a relation of total pressure to the pressure per square inch that will have to receive a little attention in bearing work, and it is on this account that the makers of automobile motors expend so much valuable time in scraping bearings.

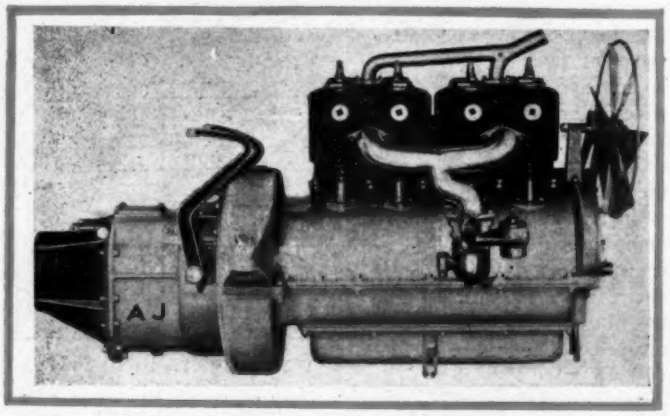
As a further indication of the great variations that take place in the pressure on bearings reference may be had to Fig. 2, in which (A) presents curves of the pressure on gudgeon pins of both double-acting steam engine and a gasoline motor. It will be observed that the pressure on the pin of the steam engine is much softer than it is in the case of the gasoline motor, and that the variations in pressure in the gasoline motor example are sharp. An examination of the curves (B) of the same figure will disclose some very high bearing pressures; the maximum pressure is not far from 1,410 pounds per square inch. There is one other point that this curve brings out; the pressure on the pin is not nearly the same when the load changes. Strange as it may seem, the pressure is very much greater when the motor is running at full load and half speed than it is at full load and full speed. This casts light on the troubles that come to motors on long grades. When the pull of the motor is maximum for the minimum speed, the danger of trouble is greatest. Automobilists who do not care to slide gears, if this point is well taken, are the ones who will be singled out for a large repair bill. It is on this account that the builders are paying so much attention to the bearing question, making sure that the projected area of the bearings will be liberal, and, in view of the difficulties involved, scraping in the bearings with more than ordinary care.



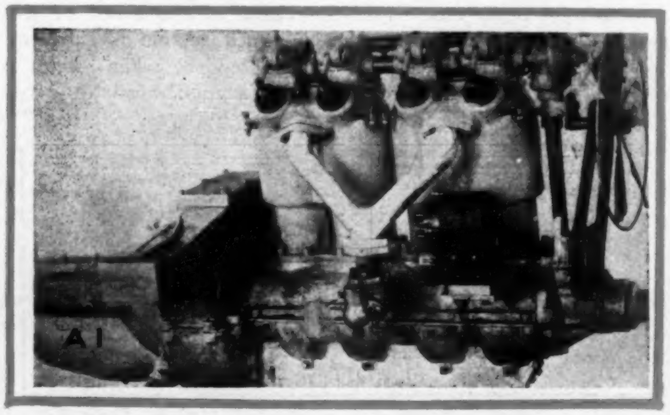
Chalmers Thirty Unit Power Plant



Hupmobile Unit Power Plant



Ohio Type of Unit Power Plant



Jackson "30" Power Plant

Pump Capacity Is a Prime Consideration

It is not the presence of a large supply of lubricating oil in the well that makes a good running motor, and designers no longer rely merely upon a large pump and a method of driving the same. It is important to consider the effect of speed and pressure on the output of the pump, and much admirable data has been collected in this division of the field. Fig. 3 shows three sets of tests of reciprocating pumps, and at (A) the effect of speed under a given set of conditions is set down. Taking the pressure curve I, in this chart, it will be observed that the capacity of the pump went up with increasing pressure, but the curve II of the same chart shows a falling off of the capacity

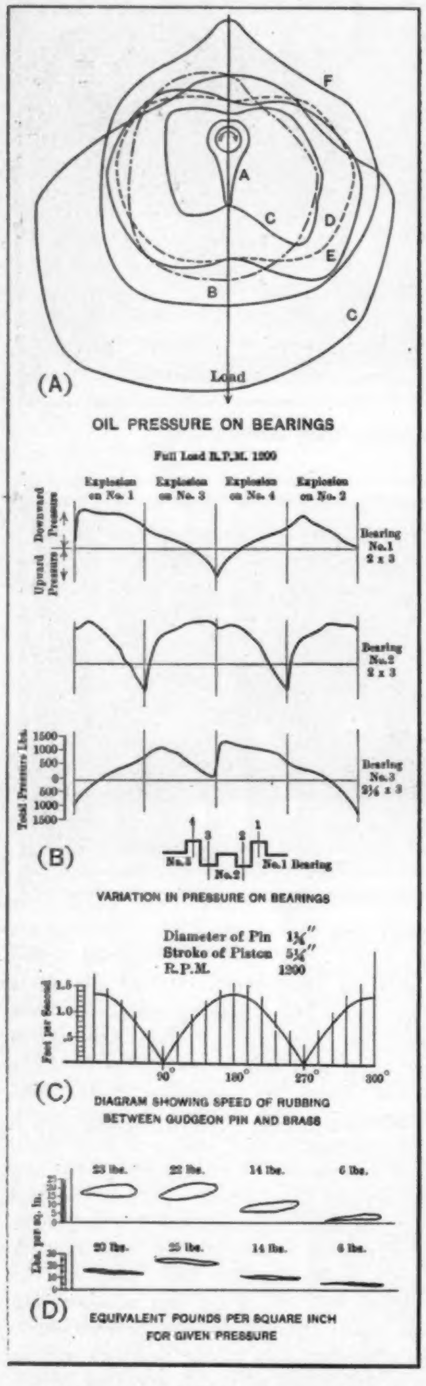


Fig. 1—(A) Variations of oil-pressure on bearings; (B) Variations of pressure on crankpins; (C) Speed of rubbing of gudgeon pin; (D) Equivalent pressures in pounds per square inch

of the pump as the pressure increased; the speed of driving of the pump was higher, thus indicating that the speed of the pump must be considered concomitant with the pressure, or an allowance must be made in the capacity of the pump. The curve III shows the performance at a still higher speed, and the capacity of the pump lowered in consequence, but not so much in proportion.

The curve (B) of the same pump under different speeds and pressures, shows a difference in the performance, and if the reader will note that the temperature of the lubricating oil was 68 degrees Fahrenheit in this example instead of 63 degrees as in the case (A), it will be possible to account for the differences realized. In the same way, by examining the chart (C) of the same figure it will be observed that performance is widely altered and attention is called to curve IV, representing the performance at 1,370 revolutions per minute, in which case the capacity of the pump fell away to 0 at 44 pounds per square inch. In this case the temperature of the oil was 66 degrees Fahrenheit, and the suction head against which the pump had to lift was 2 inches. This is a fine example of how failure can be courted in the absence of a little investigation, and it is worthy of note that makers have settled a large number of problems of just this type within a year.

The oil pipes and oil ways should be ample in area, free from sharp bends and corners, and of adequate strength to stand the highest pressures that may fall upon them. Where it is possible, hollow shafts and rods are used to facilitate the distribution. Oil pipes are carried in positions where they will not get in the way of overhauling, and will be protected from risk of damage. The edges of oil holes in parts subject to stress should be carefully rounded.

The best place for locating an automatic valve to relieve the pressure where heavy oils are used in cold weather is on the delivery pipe close to the pump.

A very short time is required to warm up the oil, and the trouble from this source is probably less with positive lubrication than with any other system.

That there are hidden dangers in connection with the lubricating problem may be quite well understood, but the three charts in Fig. 3 show very clearly that a slight difference in the lift of the lubricating oil from the source of supply to the force pump is sufficient to bring on an acute form of possible failure, owing to the shape of the curve of delivery of oil as the speed of the pump is increased. If the pump loses its suction it will not pick up again, and the flow of oil will then be stopped. The curve (C) IV in Fig. 3 illustrates very clearly the points to be made, and the great danger lies in the rapid falling off of the supply of lubricating oil after a certain point is reached in the range of the speed of the pump. If it can be shown that a 2-inch suction is sufficient to induce an alarming condition, this should be taken as proof of the desirability for reducing the suction head to zero.

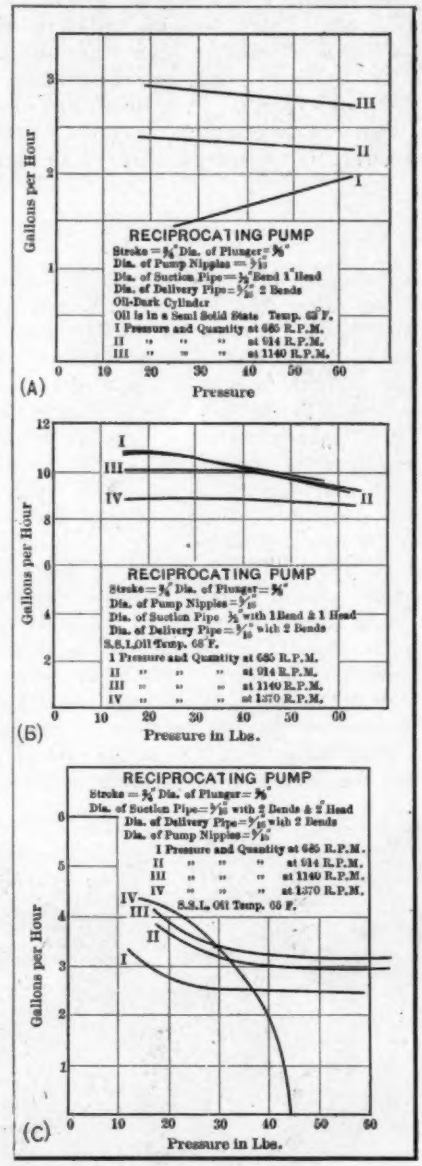


Fig. 3—(A) Capacity of an oil pump displacing oil in a semi-solid state; (B) Capacity of an oil pump displacing oil at 68 degrees Fahrenheit; (C) Pump displacing oil under a suction lift of two inches

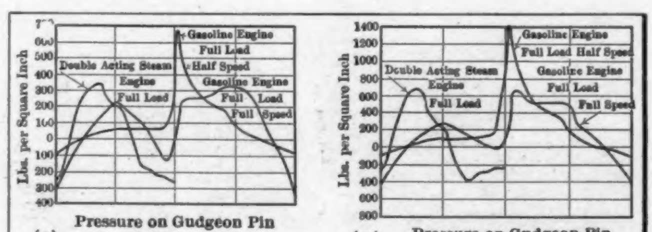


Fig. 2—(A) Observations of pressures on gudgeon pins; (B) Observations of pressures under a different set of conditions as stated

STANDARDIZATION

PROGRESS in the establishing of standards for proper guidance in the building of automobiles is being made, although to the casual observer it would seem as if inactivity has a strong grasp on the situation. The first effort in the direction of the standardizing of automobile parts was made by the "Mechanical Branch" of the A. L. A. M., and those who take an interest in automobile activities are fully conversant with the splendid results obtained, but the time arrived in the career of the various makers when it was foreseen that standardizing work must necessarily be conducted by a neutral body, so when the Society of Automobile Engineers became sufficiently organized and representative, the work of the Mechanical Branch was turned over to it, and last year, under the splendid management of President Howard E. Coffin, of the S. A. E., a plan was outlined which is as far-reaching as it is incomprehensible to the man who merely rides in an automobile. In order to push this work of standardization to the utmost limit the Society of Automobile Engineers entered into an arrangement with Coker F. Clarkson whereby he became the first managerial secretary of the society, and when it is remembered that the work of the Mechanical Branch was ably conducted by Mr. Clarkson, it will be more readily understood why the activities of the last year in the society annals have resulted in the crystallization of a plan which, by the very success it has already attained, reflects the complete standardization of the materials for automobiles, and the fixing of sizes which experience has shown will produce the desired result and make for users of automobiles that stability of investment which removed American railway practice from the realm of speculation and landed it on the platform of financial security and commercial worth.

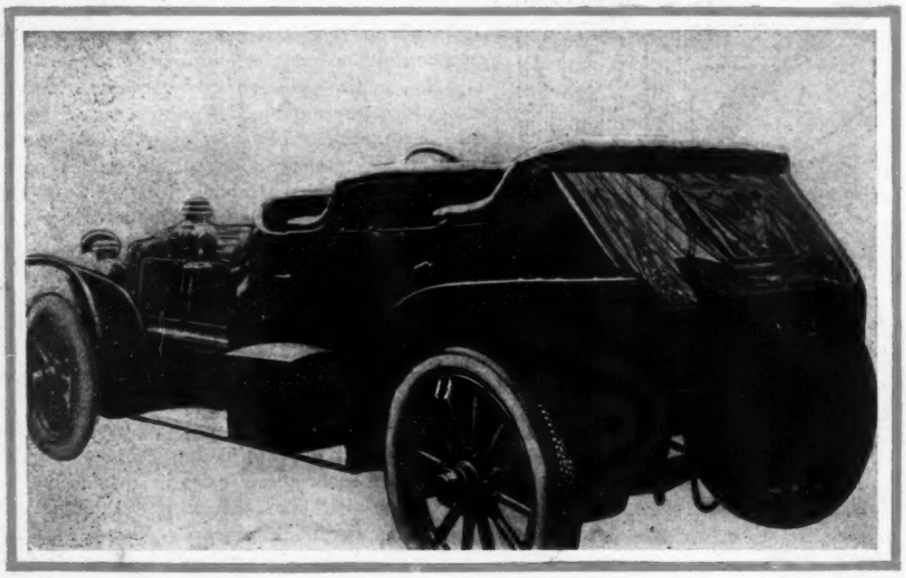
There is a tendency among the most radical of the inventive class to decry efforts at standardization. They fear that the art will be dwarfed; in other words, that the door will be closed to progress. They seem to overlook the fact that the process of standardization is a progressive one, and that the conclusions which are being reached are the result of the combined experience of all the engineers in the industry. Nor are these engineers free to reach abstract conclusions; they must recognize the potency of financial considerations, and with ear to ground they listen to the rumble as it is generated by the users of automobiles in every part of the country.

This great plan can be safely left in the hands of the men who are doing the work. They no doubt fully realize the fact that a type of car might win fame on a well-contrived racing track and yet compete but poorly with a wheelbarrow on a hilly roadway. The experience of users of cars on all kinds of roads in different sections of the country introduces such a wide variety of conditions, all of which are known to these men, that they are enabled to foresee the difficulties from every point of view, and if they fail to accept with vivacity the well-meant suggestion of the man who learns all about it in a single make of car in a certain section of the country, it is because his version is based upon observation from a single point of view and is too limited in scope to satisfy an exacting situation.

Some of the Undertakings for Standardization

Passing over the work which was done by the Mechanical Branch, it having been reported in The Automobile last year, it

will be apropos to refer at once to the standardization of pressed steel channel frames, which was taken up by the society at its midsummer meeting last year at Detroit, in which the specifications for the material were discussed at length by L. R. Smith, of the A. O. Smith Company, of Milwaukee, Wis., and tabulations were presented for side bars to be used in automobiles with wheelbase length ranging between 100 inches and 134 1-4 inches, with agreeable increments between. All necessary dimensions were carefully prescribed, and it was pointed out by numerous of the designing engineers that the fixing of these sizes should not only reduce the cost of production, but make side-frame failures a remote contingency, confining them to the results of accidents, whereas in the past "wilting" side bars were too numerous to be regarded as the proper thing. In Mr. Smith's presentation of this important subject he included drawings of side bars, giving standardized radii of curvatures, and concluded with drawings of cross bars, pointing out at the same time that the cost of production is enormously increased when each designer makes what he thinks will suit his purpose, thus requiring the mills to pile up a store house full of dies and sizes of stock that it takes a long time to get, it being the case that it would be imprudent to invest in the many special sizes of plate metal on the mere chance that a call might be made for it.

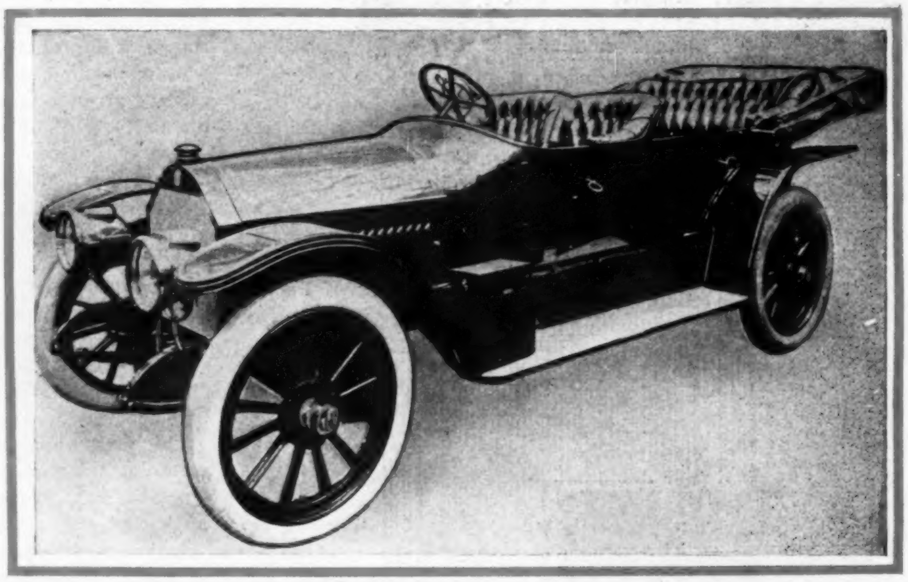


A—Rear view of fore-door type of touring car, with a torpedo stern and a cubby-hole with a trap door

Seamless Steel Tubing Was Also Standardized

It took but a very little discussion to bring to light the fact that the makers of steel tubing were required to carry in stock, or make to order, an enormous number of sizes simply because the draftsmen in the various engineering offices of the makers of automobiles put down whatever dimensions they happened to think of, frequently without consulting any list at all. As a result of an effort to standardize steel tubing it was found that 50 sizes and gauges were sufficient to cover the whole field, whereas in 1907, according to H. H. White, of the S. A. E., there were 1600 separate sizes of tubing in more or less demand from the various automobile plants, and the difficulties became so enormous that tube mills refused to stock up. They filled orders after they received them, so that the time required to procure tubing was very great indeed, and the builders of automobiles were compelled to invest in steel tubing many months before they had any use for it.

Those who study economic problems will fully understand that the place to keep the material of which steel tubing is made is in the mine until the time arrives for its actual use. Nature's store house seems to have been provided so that men would not have to pay interest on the money value of the materials therein stored, but the very instant the raw material is disturbed and it is energized by activity, the money cost is involved, and during all the period between the mining of the raw material and its final disposition, whatever amount of money is involved in the movement requires that the final purchaser shall pay interest upon it, so that it stands to reason that it is an economic fallacy to continue a set of conditions that will result in having to store stock for months, or perhaps a year or more, simply because the mills are placed in a position where it would be suicidal for them to manufacture for stock as they would be required to do under the old set of conditions. Moreover, the quality of the material is also better when there are not so many sizes to cope with; the gain is therefore manifold and certain.



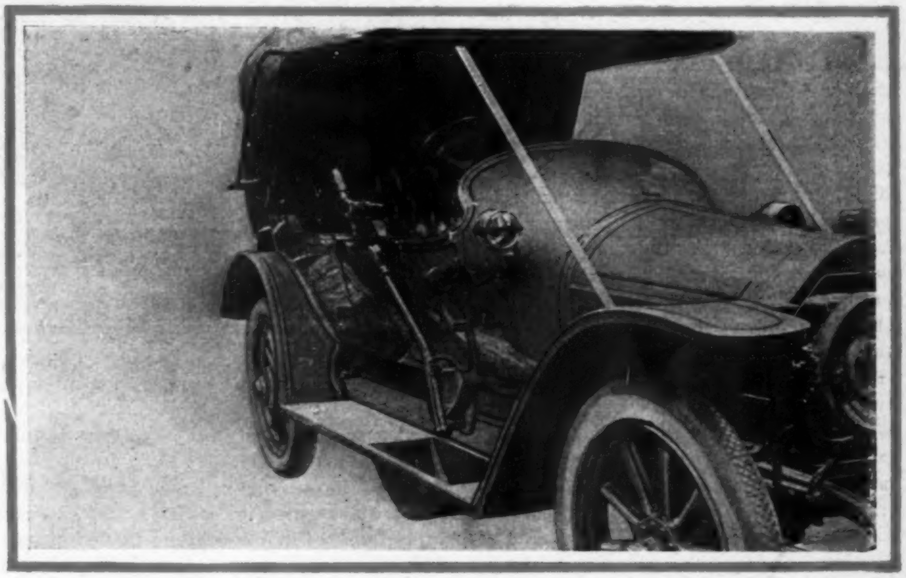
B—Fore-door type of touring body, with oval cowl, divided front seats, and a tonneau for five passengers

A Committee on Standards Has Charge

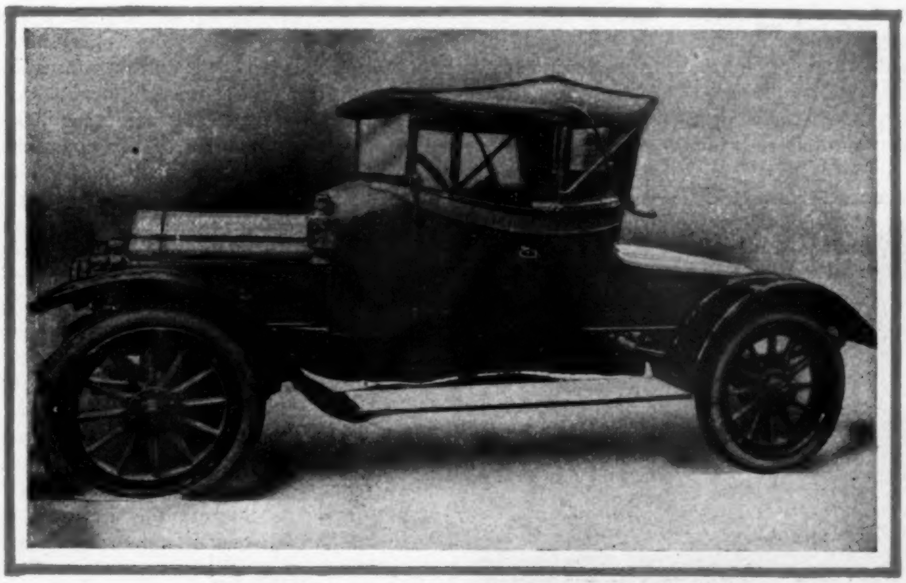
The work of standardizing steel, brass, bronze, aluminum, cast iron and other materials used in automobiles is in the hands of a large committee of automobile engineers with suitable sub-

divisions so that the different classes of materials may be given the benefit of mature deliberation on the part of men whose familiarity with the respective subjects is well appreciated by their confreres. It is the plan to have this committee report the very extensive progress it has made at the next meeting of the society, which will take place in New York City, Wednesday and Thursday, January 11-12, where the members will convene in the establishment of the Automobile Club of America.

It is more than likely that the variations of current practice in anti-friction bearings as previously referred to by D. F. Graham, member of the society, will have attention, and, doubtless, the work of the metallurgical committees will be given a wide measure of consideration. Following up the committee work discloses the fact that it has unified the many complicated questions in relation to the materials for screw stock, low carbon steel, machine steel, carbon steel for crankshafts, carbon steel for springs, 3 1-2 per cent. nickel steel, chrome nickel steel, chrome vanadium steel, silicon steel, and in the casting department, such materials as valve metal, steel castings, cast-grey iron, malleable iron, Babbitt metal, white brass, phosphor-bronze, valve bronze, yellow brass, aluminum alloys, and seven specific methods of heat-treatment which are known to be efficacious, fixing temperatures, the composition of baths, and other details. The standardized literature on the subject treats with the question involving elastic limit and tensile strength of materials, refers to elementary definitions, points out the impracticability of certain types of specifications, gives the dimensions of properly contrived test specimens, refers to the proper use of the pyrometer, gives consideration to alternate tests, and calls attention to unwise expense as when alloy steel in the unheat-treated stage is used in preference to carbon steel under suitable conditions or by reshaping parts. At all events the time has come when it is more to the point to employ appropriate grades of steel than it is to court an extravagance.



D—Fore-door type of touring car, with a "dodger" cowl and top



C—Fore-door type of body, with top and inside control

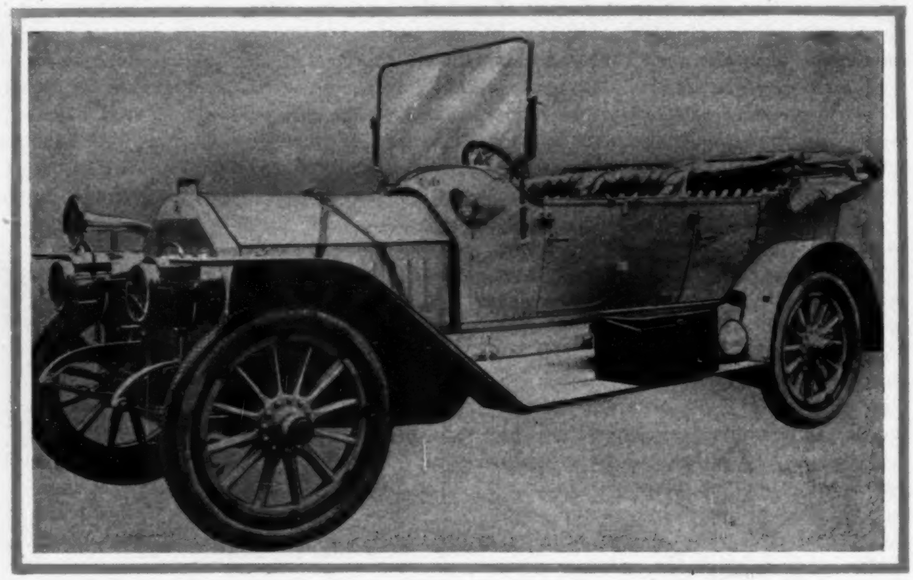
The impatience of the man who pays real money for an automobile has absolutely nothing to do with the shaping of an industry; if he gets "current" product it is all that he is entitled to, and if the model he selects is rendered obsolete by time, it is to time that he must look for the remedy. To whatever extent the dissatisfied purchaser attempts to force the indusry to take a short cut to victory, provided the influence has a deflecting trend, it is to that extent that the path will have to be retraced and the work done over again. Final and lasting success will only be present if the foundation upon which the industry rests is without a fault. Those who are directing the affairs are alive to the fact that a harmonized set of materials must be depended upon as the foundation of the industry. Fortunately, nearly all the supporters of the automobile industry are men of intelligence and discrimination, and they are capable of assuming a serene attitude and even encouraging progress along standardized lines.

There are other conditions that are working to the good of the automobile. The results of practice are refining independent of any other consideration, in other words, there is a certain automatic process going on all the time. To illustrate this point, it is only necessary to point out that when an artisan starts out to do a piece of work, if it is new to him, he will be clumsy at first, but in the course of time he will assimilate what may be called the tricks of the trade, and each succeeding day will bring its measure of refinement, so that in the long run the work will progress and become stable. But if the workman improves in time, it is no less true of the state of the machine tool art, and as each little refinement is added to the machine tools it will be reflected in the quality of the work turned out, and it is in these directions, as well as in connection with

the standardization of materials that the automobile, as a machine, is being crystallized and rendered fit.

Many Body Refinements Now to Be Had for the Asking

Before a good understanding of the progress that has been made in body designing will be fully appreciated it will be necessary to open up the "Historical" section of THE AUTOMOBILE and observe, by means of the sketches there given, what the status of body building was ten, nine, eight, or even three years ago. It should not be wondered at if the "coach-builders" of a decade ago labored under the impression that they had to be consulted and patronized when it came to bodywork, and for several years they had a marked influence upon the style, design and finish of all the automobile bodies that were turned out.



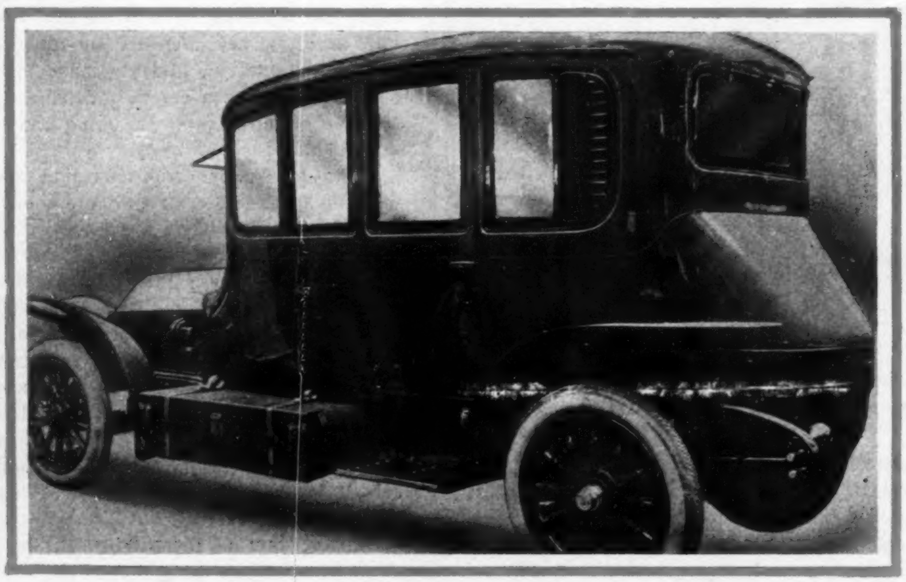
F—Fore-door type of touring car, with divided front seats, a commodious tonneau, and electric-lighting equipment integral with the overhanging cowl

But there is a great difference between a machine and a horse; this fact is rendered manifest in a hundred ways by experience. Without taking space in the discussion of the irretrievable past, as it relates to horse-drawn vehicles, it will suffice to point out that "finish" that was entirely satisfactory in vehicles of the past is not to be tolerated now. But if there are questions of finish that have to be kept in mind, they are not of the magnitude that creeps in with the matters of the shapes of bodies, as they should obtain, considering the character of the service desired and the expectations of those who have made a study of the situation.

Of the points that are receiving, and are in need of exacting attention, mention will be made of ventilation of enclosed cars, the lighting facilities and how heating should be accomplished. Then, there is the ever-present wind, especially when the automobile is traveling at a high rate of speed, although, in the Summer time a swarm of gnats will always make life miserable for the automobilist who is so rash as to go at almost any speed in an automobile that is not provided with a protective windshield, or its equipment in the form of a "dodger"-shaped cowl.

How Ventilation is Being Accomplished

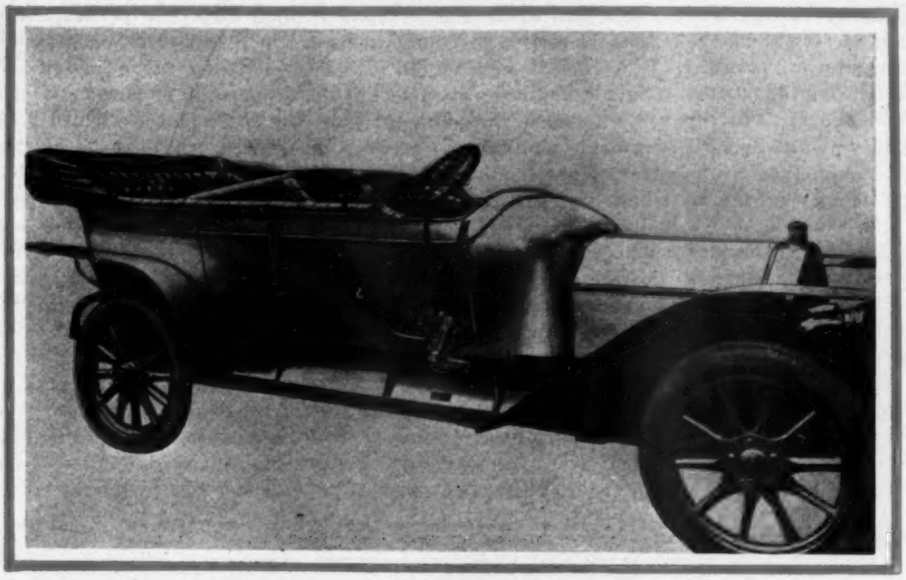
It is the limousine type of body that is the great offender from the point of view of ventilation. The man who is accustomed to cope with the ventilating problems of "public buildings" would say that it is a simple enough thing to do; all that is necessary is to place "ventilators" in the roof. But it remains for the "doctor," in this case, to remember that the air must be allowed to enter, which is a matter of admitting through an opening in the front, or through the side doors, unless it is the idea to keep the windows open. It would scarcely be worth while to go to the cost of providing windows, and, let it be admitted, windshields, if it is necessary to put them out of service in order to provide the amount of air that must be available to the occupants of the limousine if it is to be maintained with truth that it is healthy to ride in conveyances of this character.



E—Touring limousine fitted with one side door, a trunk on each running board, and storage space within the torpedo stern

This problem, like many more which the automobile art brought to light, had to be solved by automobile engineers. After a study of the matter it has been found that it is possible to properly ventilate limousines without dispensing with the facility of doors, windshield or windows, and without resorting to the use of ventilators in the roof of the body.

All that is necessary is to so adjust the two-part glass front that the air-currents will enter through the lower slit and pass through the upper opening. The air-currents so set up are sufficient to maintain a good state of ventilation in the back compartment of the limousine; so good is the effect, in fine, that smoke from a cigar will float away completely without blowing right through from the front to the back portion of the body and out through a window at the rear; but there is none of the draught that would be so fatal to comfort were it necessary to



G—Fore-door type of touring car, with an overhanging cowl and flaring smooth sides

to the life of the chassis springs to whatever extent that they may be added to in point of weight, up to the maximum demand, after which extra material is more of a detriment than it is a benefit.

Comfort and Low Depreciation Considered

From what has been said it would appear that comfort and low depreciation go as companions, just as it is reasonable to expect that a thing, when it looks artistic, satisfies the remaining consideration—strength. When a designer starts out to fashion a part, the first thing that he does is to sketch it and make changes until the part satisfies the artistic sense. If the sense of proportion is well developed, the designer will be able to so fashion the part that when he comes to make the calculations for strength there will be very little, if any, changing to do. It is not unusual for a good designer to so sketch parts guided by the sense of proportion that they will come quite right from the mathematical point of view.

It is always necessary to make calculations and find out what is the difference between the shape as dictated by an artistic eye and the proportions as they may be settled mathematically. Perhaps it is not too much to say that it would have saved a large amount of the money that has been paid out for broken springs had designers consulted the "comfort" side of the situation as it is indicated by 28-inch (deep) cushions for the seats. all, of course, with the proviso that the springs were to be given the benefit of more metal for their proper working.

Safety and Comfort Form a Close Couple

Good lighting facilities are at the bottom of the considerations for safety and comfort; certainly it is a comfortable attribute to be able to see where the automobile is going, measuring the

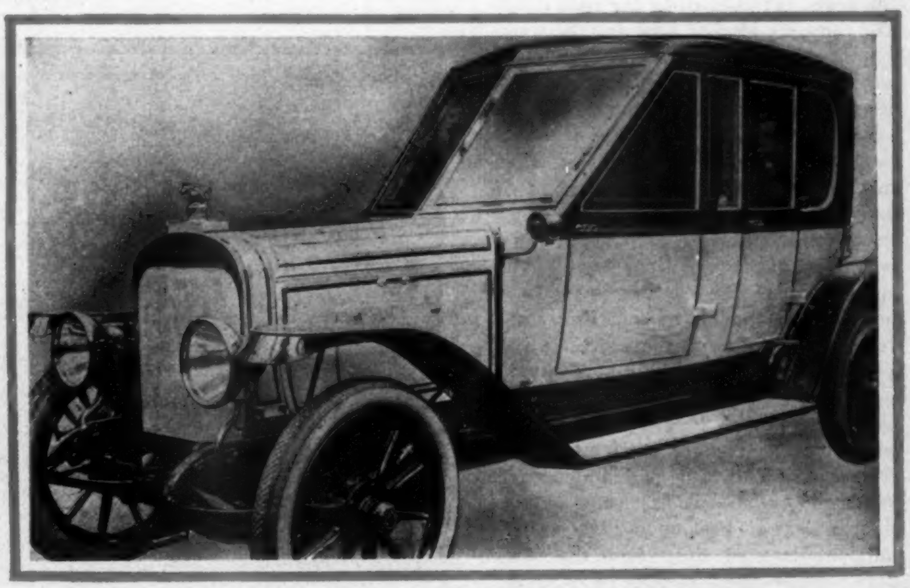
keep the back window of the body open for ventilating purposes.

In some of the very latest bodies the upholstery question is handled on an unusually attractive basis to the man who knows how much dust there is concealed in the average cushion. Wood interior work is rapidly making a name that will scarcely die out, unless, in the course of time, some material can be found that will afford the same opportunity for decorative effect, be as clean, wholesome and light of weight, and offer other attractions, without the drawbacks of upholstery, or, better yet, draperies.

The automobile bodies that are now being finished in rare woods, embellished in the many ways that are so well known to the carver and the joiner, should be known for the measure that they should add to health, the pleasing effect that they must have upon the æsthetic sense of the person of refined and cultivated tastes, and that there will also be an appeal to the financial side of the situation, is one more point; wood interior work has lasting qualities that cannot be ignored by the economist.

A brief in favor of deep cushions will include in its reasoning something about the effect it will ultimately have upon the mind of the designer of the chassis. Those who have to design springs are alive to the many problems involved, and to the fact that if the springs are to be responsible for all that may be described as "easy riding" qualities, they will be worked to such an extreme fiber strain that spring breakages must be expected at too frequent intervals.

In some of the very latest and most luxurious body designs it is the practice to make the cushions even 28 inches deep, and, in such cases, it has been found that the chassis springs may be very much heavier and far less supple, of course. It is true of springs that in addition to satisfying the conventional formulæ for strength, there must be enough metal present to reduce the molecular work to a level to accord with the life expectation. Putting deeper cushions into the body will add



H—Touring limousine, with one side door and a sloping glass front fitted V-shape in two panels, with means for ventilation

requirement from the driver's immediate point of vantage, and it is possible that the occupants of the limousine might like to while away a little time in the pleasant occupation of perusing the pages of a favorite magazine. Electric lighting is the favorite; this form of illumination is readily adapted to the needs, and dynamo electric machines, coupled with the application of tungsten lamps, make a happy combination that is improved to a wonderful degree by the supplementary use of an efficient storage battery.

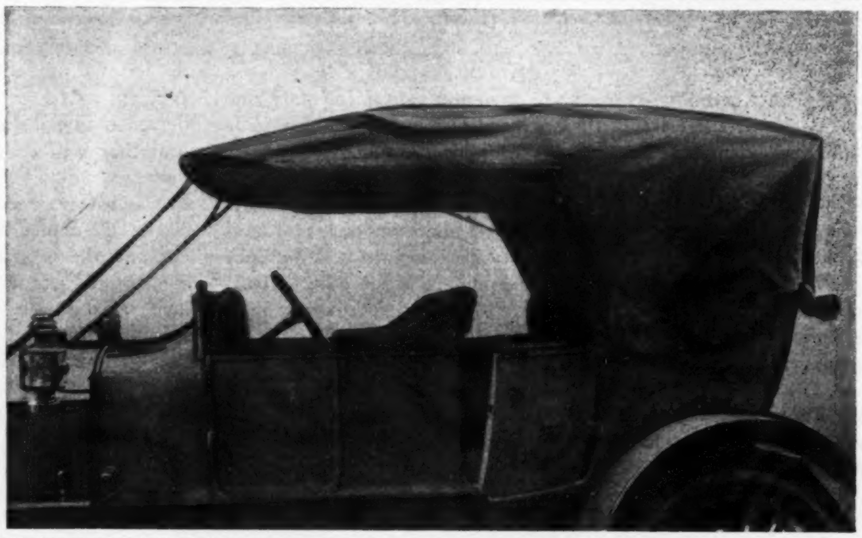
In some of the latest examples of bodies the electrical fittings and fixtures as used for lighting purposes are built in—that is to say, provision is made during the designing of the body for the lighting equipment, so that it does not occupy the unpleasant position of an appendage. There are a few examples of bodies of the enclosed type, to be seen this year, with quite an array of tungsten lamps for interior illumination, making the surroundings quite as comfortable as a well-appointed drawing room.

Space for the luggage is quite the thing in the better designs of bodies. It is even considered within the probabilities that spare tires, although they are ugly things to store, can be provided for, and quite a little ingenuity is being displayed in this deserving direction. It is not too much to say that tires do not thrive when they are located on the running-board, under the scorching heat of a Summer's sun, or subject to the other influences.

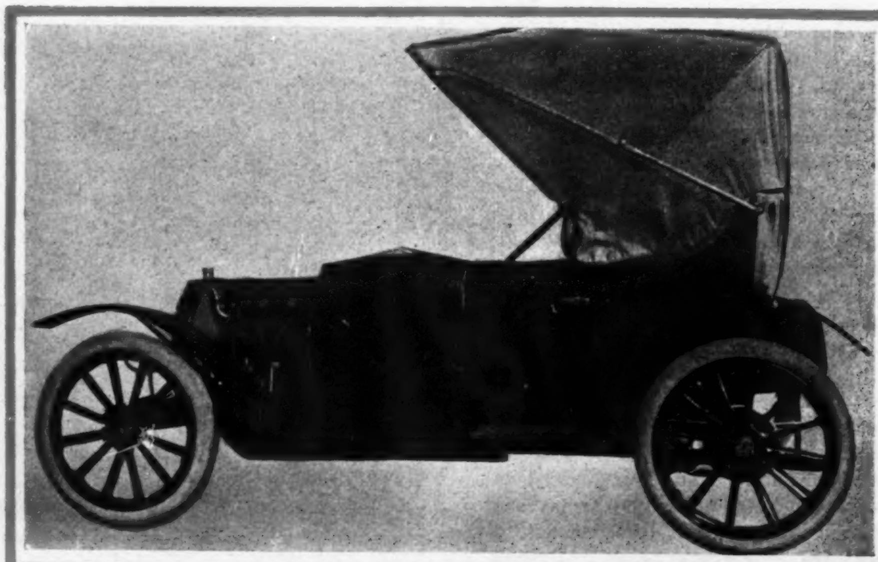
An Effort Is Needed In the Standardization of the Control Systems

It will be some time perhaps before makers of automobiles will be able to get together and agree upon some one form of sliding gear lever control equipment that will make it possible for an automobilist to step out of his make of car into a new one of another make and automatically go through the necessary motions for the proper sliding of the gears as indicated by the road condition, and his idea of how fast he wants to go. This is a great misfortune in several ways. To begin with automobiles should be safe instruments in the hands of users. The utility of a car is marred to whatever extent it is an unsafe instrument in the possession of the man for whom it is made. When an operator becomes accustomed to a certain set of manipulations he will automatically perform the necessary functions without having to consciously and deliberately study out the processes just when he is confronted by a necessity.

Just to show that these problems will be solved in the long run, it is only necessary to recount a few of the changes that have been made in a decade. When the automobile first came out designers were so bent upon adapting distinctive ideas of their own that they positively declined to employ an equipment that was known to be practical and satisfactory for no better purpose perhaps than to be able to capitalize their own idea, particularly if they were able to induce an inefficient patent office, such as this Government supports, to give them a license for a lawsuit and have it under the great seal of the commission of patents. But it was found in the course of time that freak ideas were not good investments from the users' point of view, and as soon as they found out that a thing was not valuable for its purpose they quit buying it. An examination of the tabulation of the automobiles that will be found at the Garden Show this year will suffice to indicate to the interested reader that this particular phase of the standardization question is being disposed of by an automatic process of elimination, and as the situation obtains for 1911 the three-speed selective type of transmission gear is in common use for all makes of automobiles, excepting for the few instances where the cars are so large and the necessity of flexibility is so great that the fourth speed is interjected, but even in these cases the selective type of lever is employed for the most part. Not overlooking the fact that progressive sliding is utilized to some extent, and advantageously under the conditions of its



I—Fore-door type of touring body, with a long sloping cowl fitted with a top complete for touring



J—A doctor's rig, with a single side door and overhanging cowl and top complete with the seat in the rear of chassis

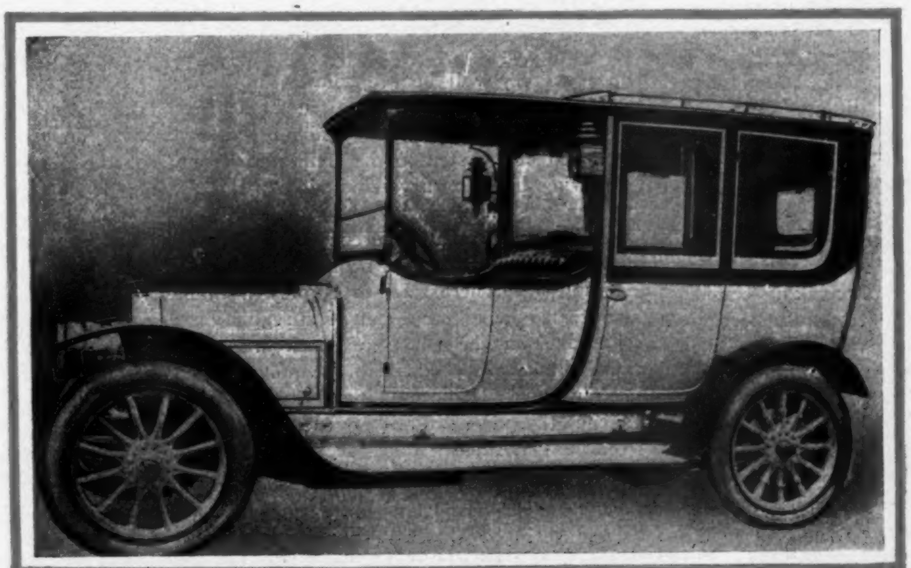
introduction, it remains to point out that very little by way of ingenuity if employed would render it possible to standardize the side lever system so that from the user's point of view the various speeds could be thrown in by a set of motions on his part that he would be able to learn by heart in the first automobile that he undertakes to drive.

Radiator Systems as Used in Cooling Work

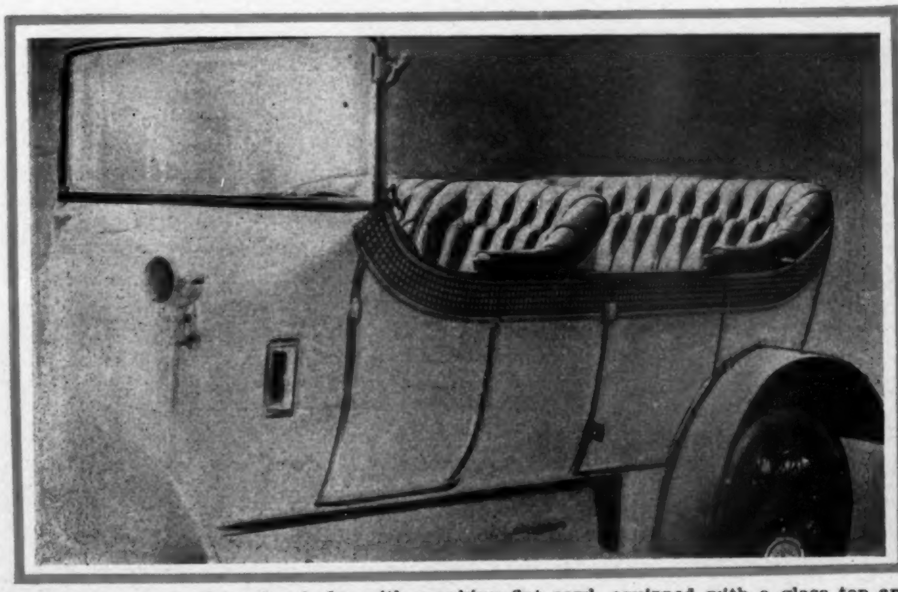
When an automobilist takes his car out upon the road he is naturally imbued with the idea that he will have to purchase and use gasoline and lubricating oil, and if he accepts the salesman's version as being a true description of the car he will have nothing more to do but to fill the radiator once with water, and thereafter drive with prudence. Let us hope that this will be true, but since there is no recognized standard of the ratio of the flame-swept surface in the combustion chamber of the motor to the radiating surface in the interstices of radiator, it is left to the individual skill of the respective designers, and since they do not all come from the same school it is highly improbable that they are using the same method in designing or agree upon the value of a unit of radiating surface under the several conditions involved.

It is generally supposed that a motor with the least possible area of flame-swept surface of the combustion chamber, if it is well designed in other respects, will be the most efficient thermally, and it is a fortunate circumstance perhaps that the size of the cooler as measured in radiating surface will be reduced to a minimum, due to the fact that if heat is prevented from passing out through the dome of the cylinders of the motor, it will not have to be disposed of by dissipation in the air which sweeps over the radiating surfaces of the cooler.

That there is a great difference in the performance of the several types of motors in the matter of the number of heat units that are taken up by the water in the jacket is a well appreciated fact, and to whatever extent this difference can be leveled in practice, it may be put down as a good stroke in the direction of standardization. The custom of ordering radiators based upon the horsepower rating of a motor, especially if this horsepower rating is established by empirical formula, is not to be recommended on the ground that it is a stab in the dark. But even if the motor data is established with much certainty there still remains a large number of incidental problems in connection with the design of the radiator, as, for illustration, the color of the surface will have a marked bearing upon the number of heat units that can be passed through a given area of the same in a given time. Physicists and others perhaps understand quite well that a very efficacious way to prevent heat from passing through a body is to give that body a high polish and impart to it the condition which corresponds to a white color, or brightness, or luster. When the builders of radiators come together and establish a standard all these questions will be reduced to a common basis.



K—Fore-door type of limousine, with an open top for the driver, fitted with a glass front on an overhanging cowl and other refinements



I—Fore-door type of touring body, with a raking flat cowl, equipped with a glass top and a means for ventilation in the sides of the body to the front of the fore-door

Darkey Preacher Keeps Abreast of Times

"De astringency ob de times, ma fellow mowtels, an' de gen'l deficiency ob de circulatin mejum connection wid dis chu'ch constrains ma tu place befo'e you all ma c'lection box dat am mo impressive dan anythin' a kin expostulate. In de firs' place, dis box am so contrived dat a half dolla', if it am let go, will fall on a plush cushion an a silent pra-a will float up to de good Lord; if a quartah am imposed 'pon de' attenshun ob de box it will fall 'pon de cushion, but dar will be no pra-a; a nickel, ma fellow mowtels, will ring a small bell dat will be distinctly heard by de congregation, but a cent in de box will fia off a pistol, and should some memba ob de congregation be so car'less as to lose a colla' button, ma fellow mowtels, a scandalous big automobile will come right out ob de box an' break one ob 'is laigs; dis am no hospital; let de c'lection p'ceed."

What Makes Noise?

HOW IS IT PREVENTED? IS THE POWER OF THE MOTOR EATEN UP BY IT? DOES IT TAKE POWER TO ELIMINATE IT?

WIND, especially the north wind, as it whistles down narrow streets, swings every tin sign as it hangs by its rusty hinges to a spike, and the noise that follows is due to the vibrations of the thin metal swelled by the creaking of the rusty hinges. Loose mudguards swinging in the breeze are just as efficacious when it comes to noise, and, why should it be considered strange if the character of the noise is precisely the same?

The curfew bell in the spire of the village meeting-house, melodious and deep in its intonations to all but children and lovers, holds in the hollow of its metal chamber walls the very principle that some designers love so well that they use bell shapes; if the curfew bell tells children to go to bed it also tells automobilists that they will have to be a little more lynx-eyed and keen of hearing the next time it falls to their lot to purchase an automobile. The prisoner by the roadside in the South suffering a term of durance vile is chained to a cannon-ball to keep it from rolling down hill and away perhaps. At all events, it is a clanking chain, and its familiar sound greets the ear of the automobilist as he rolls majestically by in his 49 horsepower skimmer. Why is the sound of clanking chains so familiar to the automobilist's ear? Is it not because he carries the same character of harmony around with him? Like the prisoner, not as a matter of choice. The linkages and levers of the brakes of his automobile are as ill-fitted as the smell of the exhaust from the motor with a poorly adjusted carbureter—they owe allegiance to the same poor designer.

Go aboard a ship; listen to the anchor-chain as it pays out link by link through the hawser-pipe; catch the sound; what is it like? Does it not make a good imitation of a chauffeur sliding the gears of a taxicab?

Pass a boiler factory; let the doors be closed to muffle the raw sound. What is the impression? Does it not constitute a good imitation of the noise that some trucks emit?

Does Noise Take Some of the Power?

What a strange question to ask! Who ever heard an automobile make a noise when the motor was stilled? Certainly power is absorbed by the parts that are responsible for the noise every time there is a bark or a clank. Is there much of a power loss from this source? Why not? Does it not take much pressure to bend a bar of steel or deform a casting? When a car is to be brought to rest from a high speed, what is the right thing to do? Clap on the brakes? Yes! What are brakes? Bands fitted over drums. Do they differ from shafts in ill-fitting journals that bind every time the shafts bend and turn? Only in general appearance; why be deceived?

When a workman equipped with a chisel and a hammer strikes a blow in the process of chipping a casting, it is quite easy to understand that he is doing some damage to the casting—that is precisely what he is trying to do; he does not call it damage, to be sure; he desires to remove some of the metal. When gears clash what have we? They are made of hardened steel; the teeth are pointed just like a chisel; could the workman strike a harder blow than is dealt by a 45-horsepower motor? Not the kind of workman who walks around on two feet and draws pay for his labor.

When the chauffeur throws into high gear on a bad road and the body bounces up and down like a house afire, what is the result? Oh! the springs equalize the road inequalities; fine. Is the motor allowed to be a neutral witness? Would the body bounce up and down were the motor to stall? No? Why? Because the bouncing of the body consumes power from the motor. Does it amount to much? Try to bounce the body; just see if it is not quite a task. What is the result of this undue bouncing? Noise in the long run. The spring-eyes enlarge; other parts go awry, and when the noise creeps in the power required of the motor is increased and the automobile becomes a candidate for a second-hand mart.

How Is Noise Prevented in Designing?

The best way to prevent noise in automobiles is to so design them that they will bear absolutely no relation to either Occidental or Oriental musical instruments. Keep away from the tom toms; forget the cymbals; abhor the kettledrum; denounce the church bell; listen to the tuning fork only for the purpose of knowing how to survive its wiles; and as for the bagpipes have none of them.

But there is a great difference between muffling a sound and preventing its growth. If sounding boards are used to defeat the result it is necessary to employ a muffler. The muffler, while it may be in the form of a regulation device, will, more likely, take on the shape of thick walls, and in either case power will be absorbed from the motor to compensate for the noise tendency. If the muffling is done by a device that is placed to silence the noise after it is generated, power will be absorbed by the muffler, since it takes energy to overcome energy, and in addition there remains the weight of the device, and power must be expended in transporting this weight.

Almost all forms of gears make a noise due to the bell shape they approximate. How to make gears that will not generate noise is an art that is as yet to be mastered. Deadening the sounds that emanate from gears means thick walls and some form of grease that will adhere to the gears, crawl in between the pressure faces, and in other ways dampen the vibrations or so slow them down that they will no longer serve as squealers. But gears do not offend half as much as a carbureter that is ill contrived for the motor it is supposed to serve; the wheeze made by the wind as it whistles through the orifice merely tells how the carbureter is as a vampire throttling the motor.

A difference of one pound per square inch in the depression of the intake is enough to reduce the power of the motor fully 20 per cent., but it is a great misfortune that the gasoline consumption will go up enormously even in the face of this loss, so that the thermal efficiency is on the most miserable possible basis concomitant with the falling off of the power.

But if the carbureter is too large, instead of being too small, the amount of gasoline that will be sucked in will be reduced, but to no good purpose. It is just as much of a detriment to mix too much air with the gasoline as it is to suck in too much gasoline with the air. Now, both of these conditions lead to the very noise of this story; it is self-evident that a motor that is incapable of doing the allotted work will labor. If quiet action is desired it must come from a power plant that is easily capable of doing the work; climbing up a flight of stairs is no more a breath-absorbing problem for a man than climbing up a hill is to a motor that is physically deficient.

REIGN of RUBBER

THERE is an absolute demand at $2.40 per pound for every pound of Para rubber that can be produced. Such being the case, it is evident that the supply of wild rubber is in danger of falling below the required amount. All the more urgent, then, is the need of increasing the rubber plantation areas. In 1830 the first piece of rubber seen in America was brought from India. As it was found to be useful in rubbing out lead-pencil marks, it was named India rubber. There was but one piece of rubber in London in 1770. A curio-hunter paid a shopkeeper three shillings for it. Sailors arriving in the United States from South America in 1823 wore rubber shoes comprised of a single piece. Goodyear vulcanized rubber in 1843. As late as 1866 rubber shoes and rubber bottles aggregating four thousand tons yearly were imported into the United States from Brazil. In 1776 an Englishman filched 70,000 Para rubber seeds from the Amazon River region and shipped them to Kew Gardens, London. Two thousand of the seeds proved to be sound. The seedlings were planted in Ceylon. They propagated. By the year of 1898 the East India Government had solved the problem of plantation rubber culture. It was not until 1907 that the industry began to cut any appreciable figure in the world's agricultural work. The total output of rubber last year, including all sorts, amounted to 69,372 metric tons (2,204.3 pounds to the ton), or 152,897,269 pounds, whose value reckoned at $2.40 per pound, the price to which rubber had settled in June, 1910, was $366,953,445.60. In April, 1910, the price of rubber vaulted to the highest point in history, namely, $3.12 per pound. The price of all rubber is based on up-river fine Para. The name, Para, is used to designate the kind of rubber which is gathered along the Amazon River and its tributaries. The world's supply of rubber, not including Guayule and Pontianac, comprises three classes: Para, plantation and other sorts. Plantation rubber is the product of Malay and Ceylon plantations. In quality and price it is identical with Para rubber in almost every particular.

The rubber industry in wrapped up in romance. Suppose it were an historical fact that a particular community of people, numbering two thousand a few generations ago, could be referred to as the ancestors of many millions of children of divers ages? The matter would instantly claim the attention of the world. These are, however, relative figures, which, if applied to a single phase in the rubber plantation industry, furnish the basis for a romance engrossing in interest. Comparison is found in the fact that the millions of rubber trees now growing in the Malay States, and the tens of thousands of rubber trees that have been planted and that are being planted by the Colonial Government in British Guiana, owe their origin to two thousand rubber seeds that were—to put it in the politest language possible—purloined from Brazil. To these localities the Para rubber plantation industry of the German colonies also must be added. Nor must one lose sight of the fact that the United States Government is swinging into the rubber belt, reference being made to America's colonial possessions, the Philippines, whence five thousand Para rubber seeds were recently ordered sent from the Botanical Gardens in Singapore.

Young Para Rubber Tree and Typical Coolie Labor-foreman

The development of the plantation rubber industry from its incipiency to its present really gigantic status furnishes proof enough in the way of incidents to warrant the assertion that there is a pathetic human interest side to the efforts of men who have been instrumental in developing the wild milk of virgin forests to the consistency of a stable commercial product until it has taken its place as an indispensable factor in the markets of the world.

Para Rubber Tree nineteen months old.

The earliest history of rubber, as a crude product oozing from wild forest trees, dates back to the year 1730, when the first specimen of rubber was brought from India to America. It was utilized for erasing lead-pencil marks, and for this reason it was referred to by pupils and school teachers as a "rubber." It was due to this fact that the general product, whatsoever its source, is known as India rubber. Our great-grandfathers, our grandfathers, and even our fathers, looked upon rubber as a curiosity. As late as the year 1770 there was but one piece of rubber, a cubic inch in size, to be found in London. A hunter of curios paid a shopkeeper three shillings for it.

In the year 1819 a Scotchman named Charles MacIntosh discovered after a series of experiments that rubber was soluble in naphtha. But he was unable to gain a victory over the coherency of the substance to a degree that prevented it from "running." The difficulty grew out of the fact that wild rubber becomes brittle in a temperature below 32 degrees Fahrenheit, while it "runs" if subjected to a temperature above 70 degrees. In his efforts to remedy this defect in his series of experiments, MacIntosh spread the dissolved rubber over two pieces of cloth and pressed the besmeared sides together. The outcome of these tests was the process now known as "MacIntoshing" cloth.

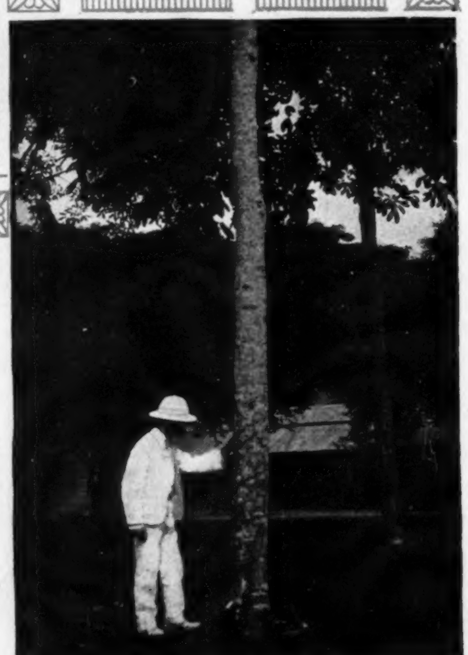
It was not until 1823 that the Americans began to get any sort of a practical understanding of rubber as a commodity that might be shaped into wearing apparel. A number of sailors arrived from the Amazon River region, having their feet encased in elastic shoes, each composed of one piece. They could be put on and pulled off at will. The sailors characterized the material out of which the shoes were made as a "gum," which, they said, the South American Indians procured by gathering milk from trees. Having smoked the latex, they moulded the rubber to their feet.

For a considerable time thereafter sailing vessels coming up from South America to the ports of New York, Boston and Salem carried cargoes of rubber boots and rubber bottles. The Yankees fetched their own wooden lasts to their shoemakers to have rubber shoes made from the raw rubber which was sometimes brought into port. They paid as high as $5 a pair for overshoes. The bottles that came in were curiosities, having been manufactured by the South American Indians. They moulded the raw rubber over lumps of clay, and the rubber having hardened they dissolved the clay, leaving the rubber bottle. By the year 1866 the rubber shoes and bottles reaching the three ports named amounted to four thousand tons annually.

In 1843 Charles Goodyear, a native of Connecticut, succeeded, after heart-breaking experiences that frequently brought him to the verge of starvation, in vulcanizing rubber. As the result of his victory it is now possible to subject vulcanized rubber to atmospheric conditions ranging from 12 degrees below zero to 300 degrees Fahrenheit above zero with perfect safety. By reason of Goodyear's discoveries, the world's total output of rubber, which amounted last year to 69,372 metric tons—152,897,269 pounds—and valued (reckoning at $2.40 per pound, the June, 1910, price of rubber) at $366,953,445.60, is being utilized as a commercial commodity. A very considerable proportion of the rubber that is produced annually is utilized in the manufacture of automobile tires.

Up to the time of Goodyear the pursuit of the rubber industry had been confined to the gathering of wild rubber in the tropic forests. Frequently the work was attended by experiences that culminated in tragedy.

In 1865 Ceylon's coffee plantations went down in the baneful labyrinth of a disease which baffled the skill of agriculturists in all attempts to check it. Ceylon's planters could not, however, afford to allow their estates to lie idle. They began to cast about to find a profitable substitute for coffee planting as an industry. Their attention had been called to the possibilities of rubber as a commercial factor. By the year 1876 they had fully decided to give this phase of agricultural industry a trial.



Para Rubber Tree Fourteen Years Old

Tapping Para Rubber Trees in Ceylon.

Herringbone System of Tapping.

An Englishman named Markham, a botanical agent in the employ of the British Government's Agricultural Department in East India, had just won the confidence of the Colonial officers through his successful introduction of the cultivation of cinchona (a genus of trees, some of which yield the bark whence quinine is obtained) into that country. Markham also had made a study of the rubber-raising situation. Having reached the conclusion that the cultivation of plantation rubber could be made a profitable business, he convinced the officials to this end. He also induced them to believe that the psychological moment had come for Great Britain to step in and lay hands upon a share of the rubber industry, along the lines which he deemed logical, and by reason of which plantation rubber cultivation would in time take its place among the world's most important agricultural enterprises.

Having implicit faith in Markham's proposition, the East India Government commissioned an expert agriculturist, W. H. Wickham, to go to the Amazon region for the purpose of securing, if possible, the sinews of the hoped-for industry. With his commission in his pocket, Wickham made his way to South America. After having undergone numerous trials which were not lacking in adventure, dangers and hair-breadth escapes, he succeeded in piercing the heart of the Amazon, two thousand miles up the river, at Manaos. This statement will be better appreciated when it is explained that until the year 1876 no steamer had succeeded in picking her way up the Amazon River as far as Manaos. Wickham was quick to find out that it was absolutely incumbent upon him to keep his mouth shut relative to his mission. He learned that if the Brazilians should detect him in the act of robbing their country of rubber seeds his life wouldn't be worth an ounce of latex. He was in a quandary as to how he should manage to get the seeds out of the country, when the *Amazonas*, a steamer flying the British ensign, made her way up the river and limped into Manaos. She was the first steamer to thrash her course through the waters of the Amazon to that port. The skipper was without a penny to pay his crew. A brilliant idea struck Wickham. Knowing the skipper's frantic desire to raise a bit of credit, he chartered the *Amazonas* in the name of the East India Government. Within a few hours, while the little brown brothers of Brazil had their backs turned, Wickham saw to it that the crew of the steamer carried on board seventy thousand rubber seeds. The British craft cleared with a cargo of property stolen from South America. The plunder was labeled:

"Rare botanical specimens for Kew Garden, London."

After threading her course down the river the steamer boomed out into the open swell of the ocean, and in due time she sailed up the Thames River to her London berth. Mr. Wickham conveyed his precious cargo of rubber seeds to Great Britain's Department of Agriculture in Kew Gardens. Two thousand seeds were preserved of the seventy thousand taken out of Brazil. Ultimately the seedlings were shipped to Heneratgoda and Peradeniya, Ceylon. From the time that Wickham started on his seed hunt until the two thousand seedlings were planted in Ceylon, the East India Colonial Government paid out the sum of fifteen hundred pounds sterling ($7,500) in forwarding these experiments with rubber seeds. The government defrayed all of the expenses incurred in procuring and cultivating rubber seedlings for the next twenty-two years, or until 1898, which period may be considered as the beginning of the plantation rubber industry. However, not until the year 1907 did the industry settle down to a basis in which it can be said to have cut any appreciable figure in the world's agricultural work.

Coagulating and Finishing Rubber in Malay

In the Purchase of a Car

THE TENETS FOR ECONOMY ARE OSTRACIZED BY THE AVERAGE MAN WHEN HE GOES IN QUEST OF AN AUTOMOBILE—RESULT: DISAPPOINTMENT

AUTOMOBILE purchasing, like the acquisition of anything that is valuable, demands deliberation on the part of the one who is interested, and it remains to conduct an investigation, not so much of the automobiles that are to be had, but of the requirements, considering the nature of the service that is to be rendered, and the force of the obstacles that are to be overcome.

The average man, before he goes in quest of a car, expends quite a lot of his time in the accumulation of the necessary funds, but, instead of duplicating this effort in the process of disposing of his funds, he busies himself with the thought that the sooner the task is satisfactorily completed the better it will be for him.

Thoughtless persons might be constrained to retort that this haste will at least redound to the advantage of the man who is most handy when the ill-advised purchaser rushes away, impelled by a single train of thought: With whom will I deal? To whom will I go with my funds in hand? Certainly I want to get a good automobile.

Thoughtless, indeed; it is never an advantage to accept money from a man unless he is placed in a position of equal advantage. The shortest road to destruction for a maker of automobiles lies between producing inferior automobiles and permitting purchasers to indulge in bad selection. Of course, the maker of poor automobiles is the man to whom advice, free or otherwise, is never welcome; this is the type of man who will not be in sympathy with educational methods; it is he who would say, "Why let the cat out of the bag?"

In the decade that automobile building has occupied the serious attention of thinking men, history, short as it really is, tells a simple tale; it clearly indicates that it is again "the survival of the fittest." But if it is written in the "permanent record" that among makers only the fit survive, the fact is also clearly defined that among users those who make wise purchases are the ones who survive.

Is it not true that there are now so many good automobiles to be had for the asking, accompanied by the funds necessary, as to render it almost an impossibility to actually fall by the wayside? No doubt it is quite true! Unfortunately, and the thought is old, the banker who selects a five-ton truck to take him to business will soon find that, while he is a heavyweight, his avoirdupois is below the required mark.

But if the same banker, simply on account of his access to a vault full of gold, purchases a car guided by "cheap money," he will have himself to blame if he has to go to the country to locate real estate enough to enable him to turn the automobile around. That a banker will take more kindly to a well-made "town car" is the firm contention, and statistics, so far as they go, seem to bear down heavy on this theory.

A doctor, with a sparse practice, on the other hand, would have difficulty in making his patients believe that he should affect so much style, but this trouble would be play alongside of his struggle to make both ends meet. For the man who needs a larger "practice" and a more substantial income than he is enjoying, it remains for him to select a "doctor's rig."

The contractor, especially if he has ladders and supplies to deliver at a dozen points about town, can scarcely afford to destroy a full-grown touring car and charging the cost up to his business; and, were such a course to be pursued, it is more than likely that the contract price thereafter would be too high to let him in on very many jobs. As to the contractor, he has the choice of a number of relatively inexpensive automobiles; each of them offering some special advantage; none of them so defective in any direction as to defeat his aim; the body should be so contrived that the supplies may be taken along.

The laundry, or the corner grocery; they are enterprises that cannot afford to support costly delivery service; a single-horse rig, in the past, has answered for these modest requirements. Why should tradesmen of this stamp want to go beyond a few hundred dollars for an automobile to do work that was formerly done by a one-horse rig? Why should they have to do so?

As a general proposition, an automobile will last for a very long time if it is not endowed with too much power, even though it may not be composed of extra good material, and notwithstanding the fact that the workmanship is far below that which embellishes the high-priced car.

It is a fortunate circumstance that automobiles last, not so much according to the quality of the material used and the character of workmanship, but in proportion as they are driven slowly, and lubricated. Putting this thought in the form of a tabulation, taking into account the "law of squares," the following will hold:

ESTIMATED MORTALITY (SO-CALLED) OF AUTOMOBILES

Tl. weight in pounds	Speed in miles per hour	Horsepower of motor	Using the finest materials	Using ordin'y materials
1,000	20	10	100.000	75,000
2,000	40	40	12,500	9,375
3,000	60	60	3,469	....
4.000	60	60	2,430	....
5,000	10	70	60,000	50.000

Note—The constant 100,000 is taken as a standard to which all the remaining constants hold a relative position. Just what this would mean in miles is difficult to say; we do not have to learn.

The table affords information that should have a marked bearing upon the attitude of the purchaser with a lean pocket-book. It is there indicated that an automobile weighing 5,000 pounds, if it is limited in speed to 10 miles per hour, will last fully half as long as a car of one-fifth the weight, provided the latter is required to go at double the speed of the heavier car. This is equal to saying that it is not weight, but speed, that saps the life out of an automobile. Making another comparison; the table indicates that an automobile that weighs 2,000 pounds, if it travels at the rate of speed of 40 miles per hour all of the time, will last only one-eighth of the life of a 1,000-pound automobile, if the latter is only required to go at a speed of 20 miles per hour. But if an automobile weighing 3,000 pounds is driven at a speed of 60 miles per hour all of the time, the life of this car, in comparison with the 1,000-pound automobile, will be in the ratio of 3,469 to 100,000.

Weight, in so far as it keeps the speed down, is a measure for economy, and, contrary to the usual notion, it is not the weight that reduces tire-life; weight and speed combined, however, are tire-deviling propositions of the first water. If the automobile depreciates as the square of the velocity, it is then true of the tires, also, that they will last inversely proportional to the square of the speed.

From a purely economical point of view, low cost of upkeep will follow if the automobile is light of weight.

The Automobiles at the Garden

PRESENTING IN TABULAR FORM WITH TYPICAL ILLUSTRATIONS THE MAKES AND MODELS OF AUTOMOBILES THAT WILL BE SHOWN AT THE GARDEN IN NEW YORK CITY

PATRONS of the automobile industry who will be interested in the exhibitions of cars as they will be presented at the Garden Show in New York City, will find it extremely difficult to avoid confusion unless some system is contrived by means of which they will be permitted to pursue their investigations on a pre-determined basis. The 67 separate makes of gasoline passenger automobiles that are to be shown at the Garden will include 468 separate models of cars, the details of which are presented in the accompanying tabulation. The form of the table has been made as simple as possible in order not to present the disadvantage which would accompany an intricate arrangement involving technical details which cannot possibly be of utility to a purchaser. The first column gives the name of the maker and the models of each make, arranged in alphabetical order. The second column is reserved for the price which is being asked for each model of the respective makes of automobiles. The third column refers to the horsepower rating based upon the A. L. A. M. formula. In explanation of this horsepower comparison it will be proper to say that the makers' ratings, in each case, may be more, or less, than that as given by the A. L. A. M. formula, and it is also true that the respective makers are justified in departing from the formula since they may, by test, ascertain exactly what their motors will deliver in the matter of power, whereas the A. L. A. M. rating, so-called, serves as a mere means of comparison from the displacement point of view, based upon a piston speed of 1,000 feet per minute.

The types of bodies are given in the table for the various models, and the seating capacity is stated. For the purpose of indicating the characteristics in body work of the several makers, at least one model of each make is presented in halftone work, the illustration being placed as nearly as possible adjacent to the position occupied by the data of the maker in the tabulation. Passing on to the motor, the cylinder dimensions, how they are cast, and the number thereof, are stated, after which the cooling question is stated, giving the type of radiator and the method of water circulation. Then comes the ignition systems, stating the types of ignition employed on the respective motors, and indicating the kind of battery used in the auxiliary ignition system. The questions of lubrication are then taken up, after which the type of clutch used in each case is stated, and in logical order the tabulation passes on to the transmission, giving just the information that the purchaser will require, including the type of transmission gear employed, the number of speeds, whether selective, or progressive, and thereafter the plan of drive is given, as shaft, or side chain, as the case may be.

The wheelbase and tread are stated in inches, and the kind of bearings employed in the crankshafts of the motors, transmissions and axles, are indicated as plain, ball or roller, and passing on to the column of weight in relation to which there is some uncertainty, and in quite a few of the models figures are left out, it being the case that the weight will vary with the type of body employed, and in some instances the cars are being completed in order that they will be ready to be shown, for the first time, at the Garden, so that the weights are really not known. The tabulation ends with a statement of the sizes of tires used on the front and rear wheels of the cars tabulated.

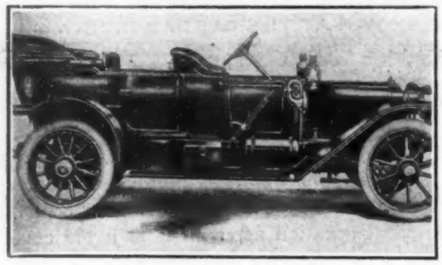
There are no doubt a good many other points that intending purchasers will want to investigate, but it is highly improbable that a mere statement in relation to them would answer any useful purpose, and the great question after all is to avoid complication, and make each effort tell for something. The table as a whole has a statistical value that might be worked out to an extreme point, but even this question, if it is carried too far, would have its end defeated, so that the statistics of the cars, with a view to simplicity, will be limited to the statement as follows:

Statistical Information of the Cars at the Garden

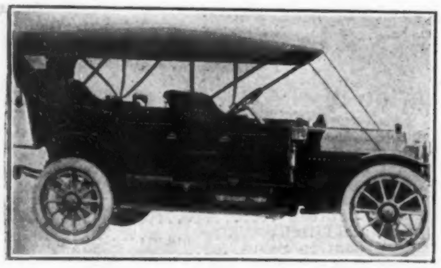
Number of water-cooled motors	450
Number of air-cooled motors	12
Number of six-cylinder motors	87
Number of four-cylinder motors	364
Number of two-cylinder motors	8
Number of one-cylinder motors	1
Number with cylinders cast individually	83
Number with cylinders cast in pairs	312
Number with cylinders cast en bloc	51
Number with integral water jackets	460
Number with separable water jackets	2
Number with separable cylinder heads	1
Number with integral cylinder heads	461
Number with thermo-syphon cooling system	49
Number using a centrifugal pump for water circulation	356
Number with gear pump for water circulation	53
Number with high-tension magnetos	430
Number with low-tension magnetos	13
Number with two-speed selective transmissions	6
Number with three-speed selective transmissions	278
Number with four-speed selective transmissions	143
Number with three-speed progressive transmissions	4
Number with four-speed progressive transmissions	none
Number with semi-progressive transmissions	none
Number with planetary gears	16
Number with friction drives	19
Number with pressed steel side frames	382
Number with wooden side frames	12
Number with plain bearing crankshafts	418
Number with ball-bearing crankshafts	43
Number with roller-bearing crankshaft	5
Number with side-chain drives	36
Number with shaft drives	430
Approximate average price of the cars	$1645.93

The embryo automobilist may get the impression that mere mass of statistical data bearing upon some one phase of the designing problem would be a sufficient indication of the fact that all automobiles should be built that way, but it is highly improbable that any reasoning along such lines will be sound. There are good grounds, for instance, why some transmission gears should have four speeds, although the majority of them are three speed selective systems, and the only real question that can come up in connection with this matter is that involving the desirability of ultimately arriving at a standard, but there are none so skilled in the automobile art at the present time as to be able to sit upon the judgment pedestal and carry conviction in any one direction. There is just as much chance that the automobile of the future will be an advance on the cars of to-day as may be measured by a comparison of the modes of transportation that served more or less satisfactorily the people of a thousand years ago with those of the present time. Of one thing we may be sure, the automobile as it will appear in 1911 is being whipped into such stable form and is so thoroughly representative of the best ideas of the day that any changes which may creep in will be slow and evolutionary in character, taking years, perhaps, to bring about a noticeable change.

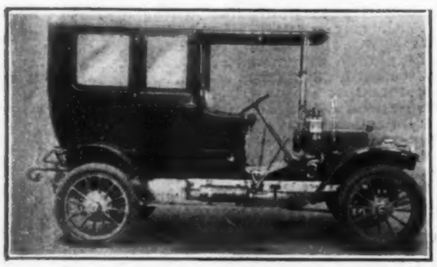
Details of Passenger Automobiles



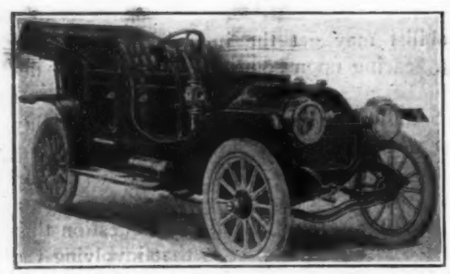
American Tourist 7-passenger touring



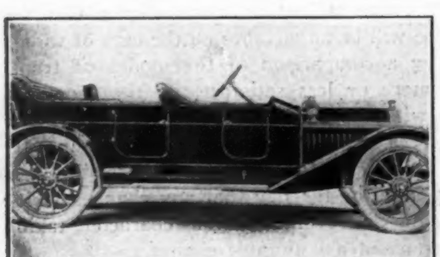
Amplex fore-door 7-passenger touring



Alco 40 H. P. Limousine



Apperson 4-30 fore-door touring



Atlas Model "O" touring car

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY		MOTOR				COOLING		IGNITION		Lubrication
			Type	Seats	Cyl.	Bore Inches	Stroke Inches	Cyl. Cast	Radiator	Pump	Magneto	Battery	
American Roadster....	$4250	46.2	R'ster..	2	4	5⅜	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
American R'ster Spec..	5000	52.9	Racy...	2	4	5¾	5½	Pairs..	Tubular.	Cent 'fl	H. T....	Storage	Pump..
American R'ster Coupe	5250	46.2	Coupe..	2	4	5⅜	5½	Pairs..	Tubular.	Cent 'fl	H. T....	Storage	Pump..
American Speedster....	5000	52.9	S'p't'r[1]	2	4	5¾	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
American Traveler....	4250	46.2	Tour'g..	5	4	5⅜	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
American Tr'ler Spec..	5000	52.9	Town...	5	4	5¾	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump.
American Tr'ler Coupe.	5250	46.2	Coupe[1].	4	4	5⅜	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
American Tourist.....	4250	46.2	Tour'g[1].	7	4	5⅜	5½	Pairs..	Tubular.	Cent 'fl	H. T....	Storage	Pump..
American Limousine....	5250	46.2	Limous.	7	4	5⅜	5½	Pairs..	Tubular.	Cent 'fl	H. T....	Storage	Pump..
Amplex H............	4300	41.0	F.d Tg..	7	4	5 1/16	5	Pairs..	H'comb..	Cent 'fl	H. T...	Ajax...	Mech...
Amplex H............	4300	41.0	B. ton..	5	4	5 1/16	5	Pairs..	H'comb..	Cent 'fl	H. T...	Ajax...	Mech...
Amplex H............	4300	41.0	R'ster..	2	4	5 1/16	5	Pairs..	H'comb..	Cent 'fl	H. T...	Ajax...	Mech...
Amplex H............	5650	41.0	Limous.	7	4	5 1/16	5	Pairs..	H'comb..	Cent 'fl	H. T...	Ajax...	Mech...
Alco 15-40...........	4500	42.0	Tour'g..	7	4	5⅛	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Alco 6-60...........	6000	54.1	Tour'g..	7	6	4¾	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Apperson—													
Jack Rabbit 4-30....	2000	32.4	Tour'g..	5	4	4½	5	Single.	Tubular.	Ro'ry.	H. T...	Storage	Pump..
Jack Rabbit 4-40....	3000	36.1	Tour'g..	7	4	4¾	5	Single	Tubular.	Ro'ry.	H. T...	Storage	Pump..
Jack Rabbit 4-50....	4000	48.4	Tour'g..	7	4	5½	5	Single.	Tubular.	Ro'ry.	H. T...	Storage	Pump..
Jack Rabbit 4-70....	4200	53.0	S.Rac'g	2	4	5¾	5¾	Single.	Tubular.	Ro'ry.	H. T...	Storage	Pump..
Atlas K.............	2400	16.2	Tax....	3	2	4½	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Atlas M.............	2400	32.4	Tour'g..	7	4	4½	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Atlas O.............	2400	32.4	Tour'g..	5	4	4½	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Atlas O.............	2400	32.4	F.d.Tg..	7	4	4½	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Atlas O.............	2400	32.4	F.d.Tg..	7	4	4½	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Autocar XXIV........	2250	30.6	Tour'g..	5	4	4⅜	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	F. feed..
Autocar XXIV........	2250	30.6	R'ster..	3	4	4⅜	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	F. feed..
Brush E.............	485	6.4	R'bout.	2	1	4	5	Block.	H'comb..	Syph'n	[2]H.T...	Dry....	Splash..
Buick 21............	1500	28.9	Tour'g..	5	4	4¼	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Buick 21............	1500	28.9	D. ton..	4	4	4¼	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Buick 26............	1050	25.6	R'ster..	2	4	4	4	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Buick 27............	1150	25.6	Tour'g..	5	4	4	4	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Buick 32............	800	22.5	R'ster..	2	4	3¾	3¾	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Pump..
Buick 33............	950	22.5	C.c.ton.	4	4	3¾	3¾	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Pump..
Buick 38............	1850	32.4	R'ster..	2	4	4½	5	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Buick 39............	1850	32.4	F.d.Tg..	5	4	4½	5	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Cadillac "Thirty".....	1700	32.4	Tou'g..	5	4	4½	4½	Single.	Tubular.	Cent 'fl	H. T...	Delco...	Splash..
Cadillac "Thirty".....	1700	32.4	D. Ton.	4	4	4½	4½	Single.	Tubular.	Cent 'fl	H. T...	Delco...	Splash..
Cadillac "Thirty".....	1700	32.4	R'ster..	3	4	4½	4½	Single.	Tubular.	Cent 'fl	H. T...	Delco...	Splash..
Cadillac "Thirty".....	1800	32.4	F.d Tg..	5	4	4½	4½	Single.	Tubular.	Cent 'fl	H. T...	Delco...	Splash..
Cadillac "Thirty".....	1850	32.4	Torp'o..	4	4	4½	4½	Single.	Tubular.	Cent 'fl	H. T...	Delco...	Splash..
Cadillac "Thirty".....	2250	32.4	Coupe..	3	4	4½	4½	Single.	Tubular.	Cent 'fl	H. T...	Delco...	Splash..
Cadillac "Thirty".....	3000	32.4	Limous.	7	4	4½	4½	Single.	Tubular.	Cent 'fl	H. T...	Delco...	Splash..
Cartercar L..........	1600	28.9	Tour'g..	5	4	4¼	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Cartercar L..........	1650	28.9	D. ton..	5	4	4¼	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Cartercar H.	1150	25.6	Min.to..	5	4	4	4	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Pump..
Cartercar H..........	1150	25.6	R'bout.	4	4	4	4	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Pump..
Cartercar H..........	1125	25.6	Dr. Rt..	4	4	4	4	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Pump..
Cartercar H..........	1100	25.6	R'bout.	3	4	4	4	Pairs..	Tubular.	Syph'n	H. T...	Dry.....	Pump..
Cartercar H..........	1075	25.6	R'bout.	2	4	4	4	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Pump..
Cartercar H..........	1050	25.6	R'bout.	2	4	4	4	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Pump..
Cartercar T..........	1350	16.2	Panel...	..	2	4½	4½	Single	Cellular..	Syph'n	H. T...	Dry....	Pump..
Cartercar T..........	1250	16.2	Open...	..	2	4½	4½	Single.	Cellular..	Syph'n	H. T...	Dry....	Pump..

[1]Fore-door type

AMERICAN—American Motor Car Co., Indianapolis, Ind.
AMPLEX—Simplex Motor Car Co., Mishawaka, Ind.
ALCO—American Locomotive Co., 1886 Broadway, New York.
APPERSON—Apperson Bros. Automobile Co., Kokomo, Ind.
ATLAS—Atlas Motor Car Co., Springfield, Mass.

The illustrations selected of the automobiles as here tabulated are intended to convey a good general impression on a somewhat comparative basis of the models that will be on exhibition at the Garden, among which are to be found a considerable number of fore-door types of touring cars, with here and there an example of a limousine, just a few standard types of touring cars, and a sprinkling of runabouts, the idea being to convey a fair representation of the trend in body designs. In the tabulations it will be found that the horsepower ratings are not those of the makers, but for the purpose of comparison

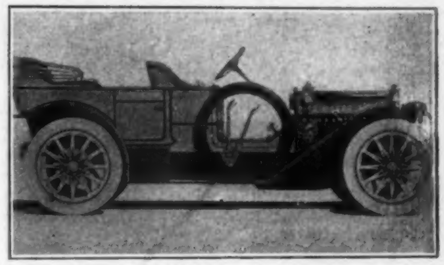
on the American Market for 1911

Clutch	Transmission Type	Transmission Speeds	Transmission Location	Transmission Drive	Wheelbase	Tread	Frame	Bearings Crank-shaft	Bearings Trans-mis'n	Bearings Axle	Weight	Tires Front	Tires Rear
Cone	Sel.	4	Unit	Shaft	112	56	P. Steel	3 Plain	Ball	Ball	2900	40x4	40x4
Cone	Sel.	4	Unit	Shaft	112	56	P. Steel	3 Plain	Ball	Ball	2600	36x4	36x5
Cone	Sel.	4	Unit	Shaft	112	56	P. Steel	3 Plain	Ball	Ball	3600	40x4	40x4
Cone	Sel.	4	Unit	Shaft	112	56	P. Steel	3 Plain	Ball	Ball	3600	36x4	36x5
Cone	Sel.	4	Unit	Shaft	124	56	P. Steel	3 Plain	Ball	Ball	3200	40x4	40x4
Cone	Sel.	4	Unit	Shaft	124	56	P. Steel	3 Plain	Ball	Ball	3200	40x4	40x4
Cone	Sel.	4	Unit	Shaft	124	56	P. Steel	3 Plain	Ball	Ball	3600	40x4	40x4
Cone	Sel.	4	Unit	Shaft	124	56	P. Steel	3 Plain	Ball	Ball	3200	36x4	36x5
Cone	Sel.	4	Unit	Shaft	124	56	P. Steel	3 Plain	Ball	Ball	3600	36x4	36x5
Disc	Sel.	3	Axle	Shaft	128	56½	P. Steel	Plain	Ball	Ball	4000	36x4	36x5
Disc	Sel.	3	Axle	Shaft	128	56½	P. Steel	Plain	Ball	Ball	4000	36x4	36x5
Disc	Sel.	3	Axle	Shaft	128	56½	P. Steel	Plain	Ball	Ball	4000	36x4	36x5
Disc	Sel.	3	Axle	Shaft	128	56½	P. Steel	Plain	Ball	Ball	4000	36x4	36x5
M. disc	Sel.	4	Unit	Shaft	126	55½	P. Steel	Plain	Ball	Ball	3900	36x4	36x5
M. disc	Sel.	4	Unit	Shaft	134	55½	P. Steel	Plain	Ball	Ball	4200	36x4	36x5
Con.b'd	Sel.	3	Unit	Shaft	114	56	P. Steel	Plain	Ball	Ball	2750	34x4	34x4
Con.b'd	Sel.	3	Unit	Shaft	122	56	P. Steel	Plain	Ball	Ball	3000	36x4	36x4½
Con.b'd	Sel.	4	Unit	Shaft	127	56	P. Steel	Plain	Ball	Ball	3600	36x4½	36x5
Con.b'd	Sel.	3	Unit	2 Chain	116	56	P. Steel	Plain	Ball	Ball	2400	34x4	34x4½
Plate	Sel.	3	Motor	Shaft	106	56	P. Steel	Roller	Roller	Roller	1600	32x3½	32x3½
Plate	Sel.	3	Motor	Shaft	120	56	P. Steel	Roller	Roller	Roller	2400	36x4	36x4
Plate	Sel.	3	Motor	Shaft	120	56	P. Steel	Roller	Roller	Roller	2400	36x4	36x4
Plate	Sel.	3	Motor	Shaft	120	56	P. Steel	Roller	Roller	Roller	2400	36x4	36x4
Plate	Sel.	3	Unit	Shaft	120	56	P. Steel	Roller	Roller	Roller	2400	36x4	36x4
Disc	Sel.	3	Unit	Shaft	117	56	P. Steel	Plain	Roller	Roller	2600	36x4½	36x4½
Disc	Sel.	3	Unit	Shaft	117	56	P. Steel	Plain	Roller	Roller	2600	36x4½	36x4½
M. Disc	Plane	2	Unit	2 Chain	80	54½	Wood	2 Plain	B.&Pl.	Ball	.....	28x3	28x3
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Ball	Ball	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Ball	Ball	.....	34x4	34x4
M. Disc	Sel.	3	Unit	Shaft	100	56	P. Steel	Plain	Ball	Ball	.....	32x3½	32x3½
M. Disc	Sel.	3	Unit	Shaft	106	56	P. Steel	Plain	Ball	Ball	.....	32x3½	32x3½
Cone	Plane	2	Unit	Shaft	90	56	P. Steel	Plain	Ball	Ball	.....	30x3½	30x3½
Cone	Plane	2	Unit	Shaft	100	56	P. Steel	Plain	Ball	Ball	.....	30x3½	30x3½
M. Disc	Sel.	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Ball	.....	36x4	36x4
M. Disc	Sel.	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Ball	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Roller	.....	36x4½	36x4½
None	Frict'n	...	Unit	2 Chain	110	56	P. Steel	3 Plain	Ball	Ball	.....	34x4	34x4
None	Frict'n	...	Unit	2 Chain	110	56	P. Steel	3 Plain	Ball	Ball	.....	34x4*	34x4
None	Frict'n	...	Unit	2 Chain	110	56	P. Steel	3 Plain	Ball	Ball	.....	32x3½	32x3½
None	Frict'n	...	Unit	2 Chain	110	56	P. Steel	3 Plain	Ball	Ball	.....	32x3½	32x3½
None	Frict'n	...	Unit	2 Chain	110	56	P. Steel	3 Plain	Ball	Ball	.....	32x3½	32x3½
None	Frict'n	...	Unit	2 Chain	110	56	P. Steel	3 Plain	Ball	Ball	.....	32x3½	32x3½
None	Frict'n	...	Unit	2 Chain	110	56	P. Steel	3 Plain	Ball	Ball	.....	32x3½	32x3½
None	Frict'n	...	Unit	2 Chain	110	56	P. Steel	3 Plain	Ball	Ball	.....	32x3½	32x3½
None	Frict'n	...	Unit	2 Chain	98	56	P. Steel	3 Plain	Ball	Ball	.....	34x2½	36x2½
None	Frict'n	...	Unit	2 Chain	98	56	P. Steel	3 Plain	Ball	Ball	.....	34x2½	36x2½

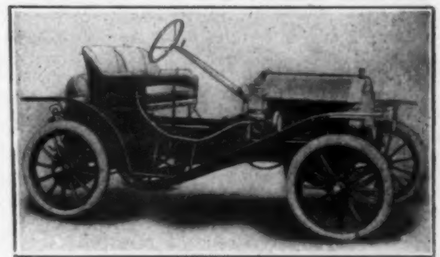
*Extra

AUTOCAR—Autocar Co., Ardmore, Pa.
BRUSH—Brush Runabout Co., Detroit, Mich.
BUICK—Buick Motor Co., Flint, Mich.
CADILLAC—Cadillac Motor Car Co., Detroit, Mich.
CARTERCAR—Cartercar Co., Pontiac, Mich.

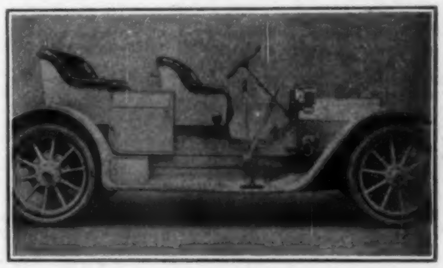
on a common basis the A. L. A. M. ratings are given. This should not be taken as license to disregard the horsepower ratings of the respective makers; the mere fact that the A. L. A. M. ratings may be above or below the maker's ratings possesses no significance; the respective makers may be quite right in their statements, but it is a convenience to be able to compare displacements of motors, if only it is remembered that the horsepower of a motor is not settled by the displacement, although it has a bearing upon the power that can be taken from a motor.



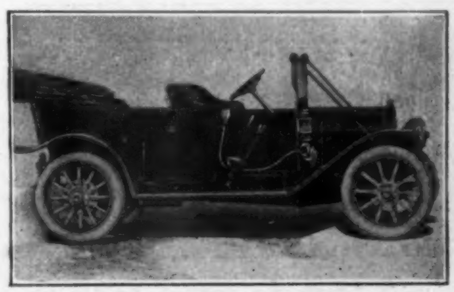
Autocar "30" 5-passenger touring



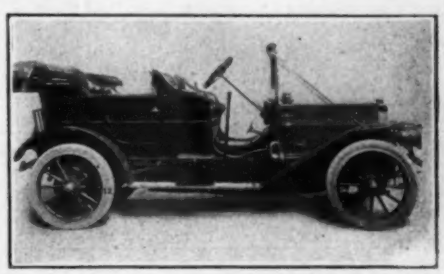
Brush Model "D" runabout



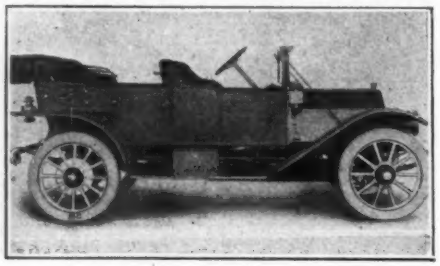
Acme S. G. V. 5-passenger touring



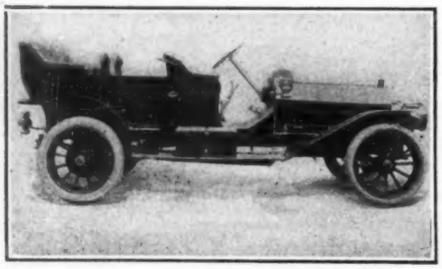
Cadillac "30" fore door car



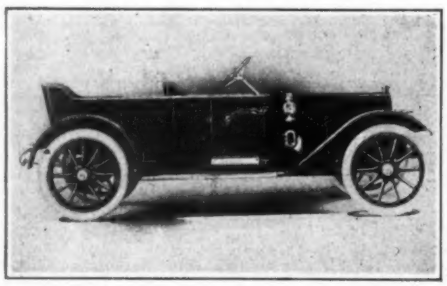
Cartercar 5-pasenger touring car



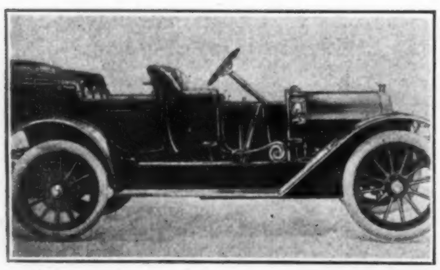
Case fore-door touring car



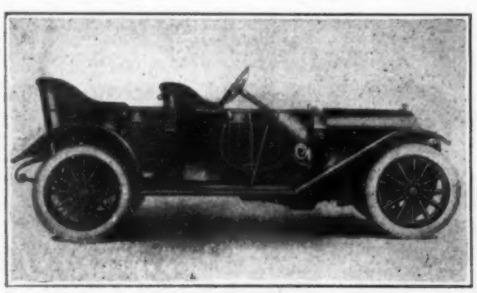
Chadwick 7-passenger touring car



Chalmers "40" with torpedo body



Columbia 7-passenger vestibule touring car



Model "30" Corbin touring car of the fore-door type

Details of Passenger Automobiles

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY		MOTOR				COOLING		IGNITION		Lubrication
			Type	Seats	Cyl.	Bore inches	Stroke inches	Cyl. Cast	Radiator	Pump	Magneto	Battery	
Case K	.....	28.9	Torp'o.	4	4	4¼	5	Pairs..	H'comb..	Cent'fl	None...	Dry....	Splash..
Case K	.....	28.9	Tour'g..	5	4	4¼	5	Pairs..	H'comb..	Cent'fl	None...	Dry....	Splash..
Case K	.....	28.9	S'bur'n.	4	4	4¼	5	Pairs..	H'comb..	Cent'fl	None...	Dry....	Splash..
Chadwick	$5500	60.0	Tour'g.	7	6	5	6	Pairs..	Tubular.	Cent'fl	H. T...	Storage	Pump..
Chadwick	5500	60.0	T'b't....	5	6	5	6	Pairs..	Tubular.	Cent'fl	H. T...	Storage	Pump..
Chadwick	5500	60.0	R'bout.	3	6	5	6	Pairs..	Tubular.	Cent'fl	H. T...	Storage	Pump..
Chadwick	6500	60.0	Limous.	7	6	5	6	Pairs..	Tubular.	Cent'fl	H. T...	Storage	Pump..
Chalmers "30"	1500	25.6	Tour'g..	5	4	4	4½	Block.	Tubular.	Cent'fl	H. T...	Storage	Splash..
Chalmers "30"	1500	25.6	R'ster..	2	4	4	4½	Block.	Tubular.	Cent'fl	H. T...	Storage	Splash..
Chalmers "30"	1600	25.6	P. ton..	4	4	4	4½	Block.	Tubular.	Cent'fl	H. T...	Storage	Splash..
Chalmers "30"	3000	25.6	Limous.	5	4	4	4½	Block.	Tubular.	Cent'fl	H. T...	Storage	Splash..
Chalmers "30"	2400	25.6	Coupe..	3	4	4	4½	Block.	Tubular.	Cent'fl	H. T...	Storage	Splash..
Chalmers "40"	2750	40.0	Tour'g..	7	4	5	4½	Pairs..	Cellular..	Cent'fl	H. T...	Storage	Splash..
Chalmers "40"	2750	40.0	R'ster..	5	4	5	4½	Pairs..	Cellular..	Cent'fl	H. T...	Storage	Splash..
Chalmers "40"	3000	40.0	Torp'o..	4	4	5	4½	Pairs..	Cellular..	Cent'fl	H. T...	Storage	Splash..
Columbia Mark 85	3300	38.0	R.ster..	4	4	4⅞	5½	Pairs..	Cellular..	Cent'fl	H. T...	Dry....	Pump..
Columbia Mark 85	3400	38.0	R'ster..	6	4	4⅞	5½	Pairs..	Cellular..	Cent'fl	H. T...	Dry....	Pump..
Columbia Mark 85	3500	38.0	Tour'g..	7	4	4⅞	5½	Pairs..	Cellular..	Cent'fl	H. T...	Dry....	Pump..
Columbia Mark 85	4800	38.0	Limous.	7	4	4⅞	5½	Pairs..	Cellular..	Cent'fl	H. T...	Dry....	Pump..
Columbia Mark 48-Lot5	2750	32.0	Tour'g..	5	4	4½	4.7	Pairs..	Cellular..	Cent'fl	L. T...	Dry....	Pump..
Columbia Mark 48-Lot5	3000	32.0	Tour'g..	7	4	4½	4.7	Pairs..	Cellular..	Cent'fl	L. T...	Dry....	Pump..
Columbia Mark 48-Lot5	3800	32.0	Land't..	7	4	4½	4.7	Pairs..	Cellular..	Cent'fl	L. T...	Dry....	Pump..
Corbin 18	2750	32.4	Tour'g..	5	4	4½	4½	Single.	H'comb..	Gear'n	H. T...	Dry....	Pump...
Corbin 18	2750	32.4	T ton...	4	4	4½	4½	Single.	H'comb..	Gear'n	H. T...	Dry....	Pump..
Corbin 30	2000	32.4	Tour'g..	4	4	4½	4½	Single.	H'comb..	Gear'n	H. T...	Dry....	Pump..
Corbin 30	2000	32.4	T.ton...	5	4	4½	4½	Single.	H'comb..	Gear'n	H. T...	Dry....	Pump..
Corbin 40	3000	36.1	Tour'g..	4	4	4¾	5¼	Pairs..	H'comb..	Gear'n	H. T...	Storage	Pump..
Corbin 40	3100	36.1	Torp'o.	5	4	4¾	5¼	Pairs..	H'comb..	Gear'n	H. T...	Storage	Pump..
Corbin 40	4000	36.1	Limous.	7	4	4¾	5¼	Pairs..	H'comb..	Gear'n	H. T...	Storage	Pump..
Elmore 25	1200	30.0	R'ster..	2	4	4	3½	Single.	Tubular.	Syph'n	H. T...	Dry....	Pump..
Elmore 25	1250	30.0	Tour'g..	4	4	4	3½	Single.	Tubular.	Syph'n	H. T...	Dry....	Pump..
Elmore 36 B	1750	50.0	Tour'g..	5	4	4½	4	Single.	Tubular.	Syph'n	H. T...	Dry....	Pump..
Elmore 46 B	2500	70.0	Tour'g..	7	4	5	5	Single.	Tubular.	Syph'n	H. T...	Dry....	Pump..
E-M-F- "30"	1250	25.6	Tour'g.	5	4	4	5½	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Gravity
Flanders "20"	750	22.5	R'ster..	[1]2	4	3¾	3⅜	Block.	Tubular.	Cent'fl	H. T...	Dry....	Gravity
Everitt "30"	1350	30.0	Tour'g..	5	4	4	4½	Block.	Cellular..	Cent'fl	H. T...	Storage	Splash..
Everitt "30"	1350	30.0	F.d.Tg..	4	4	4	4½	Block.	Cellular..	Cent'fl	H. T...	Storage	Splash..
Everitt "30"	1350	30.0	Coupe...	4	4	4	4½	Block.	Cellular..	Cent'fl	H. T...	Storage	Splash..
Everitt "30"	1350	30.0	D.ton..	4	4	4	4½	Block.	Cellular..	Cent'fl	H. T...	Storage	Splash..
Franklin G	1950	18.2	T.phaet	2	4	4	3⅜	Single.	Air-Cool.	S'n fan	H. T...	None...	Pump..
Franklin G	1950	18.2	Tour'g..	4	4	4	3⅜	Single.	Air-cool..	S'n fan	H. T...	None...	Pump..
Franklin M	2700	25.6	Tour'g..	5	4	4	4	Single.	Air-cool..	S'n.fan	H. T...	None...	Pump..
Franklin M	3500	25.6	Limous.	7	4	4	4	Single.	Air-cool..	S'n fan	H. T...	None...	Pump..
Franklin M	3500	25.6	Land't..	7	4	4	4	Single.	Air-cool..	S'n fan	H. T...	None...	Pump..
Franklin H	4500	48.6	Tour'g..	7	6	4½	4½	Single.	Air-cool..	S'n fan	H. T...	None...	Pump..
Franklin H	4500	48.6	Torp'o..	4	6	4½	4½	Single.	Air-cool..	S'n fan	H. T...	None...	Pump..
Franklin D	4400	38.4	Land't..	7	4	4	4	Single.	Air-cool..	S'n fan	H. T...	None...	Pump..
Franklin D	3500	38.4	Tour'g..	5	6	4	4	Single.	Air-cool..	S'n fan	H. T...	None...	Pump..
Franklin D	3500	38.4	Torp'o.	4	6	4	4	Single.	Air-cool..	S'n fan	H. T...	None...	Pump..
Franklin D	4400	28.4	Limous.	7	6	4	4	Single.	Air-cool..	S'n fan	H. T...	None...	Pump..
Glide	2000	36.1	Tour'g..	7	4	4¾	5	Single.	H'comb..	Rotary	H. T...	Storage	Splash..
Glide	2000	36.1	Tour'g..	5	4	4¾	5	Single.	H'comb..	Rota'y	H. T...	Storage	Splash..
Glide	2000	36.1	[3]R's er..	5	4	4¾	5	Single.	H'comb..	Rota'y	H. T...	Storage	Splash..
Glide	2000	36.1	[4]R'ster..	5	4	4¾	5	Single.	H'comb..	Rota'y	H. T...	Storage	Splash..
Glide	2150	36.1	F.d.To..	5	4	4¾	5	Single.	H.comb..	Rota'y	H. T...	Storage	Splash..

[1] And 4 seats. [2]Also 60 inches.

CASE—Pierce Motor Co., Racine, Wis.
CHADWICK—Chadwick Engineering Works, Pottstown, Pa.
CHALMERS—Chalmers Motor Co., Detroit, Mich.
COLUMBIA—Columbia Motor Car Co., Hartford, Conn.
CORBIN—Corbin Motor Vehicle Co., New Britain, Conn.

In conjunction with the tabulations and illustrations of cars complete it will be worth while to examine the illustrations of motors with a view to becoming familiar with the respective schools of designs, and the several types of motors as employed in the various makes of automobiles. Space considerations prevented the showing of the power plant of each model of car which will be on exhibition at the Garden, but by means

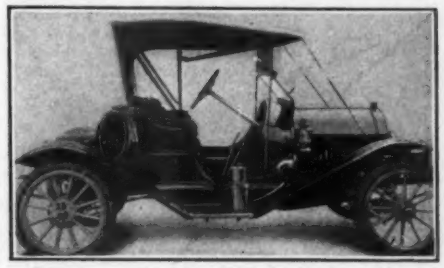
on the American Market for 1911

Clutch	TRANSMISSION				Wheelbase	Tread	Frame	BEARINGS			Weight	TIRES	
	Type	Speeds	Location	Drive				Crank-shaft	Trans-mis'n	Axle		Front	Rear
M. Disc...	Sel....	3	Unit....	Shaft....	....	56	P. Steel..	3 Plain.	Roller.	Roller...	[illegible]	34x4	34x4
M. Disc...	Sel....	3	Unit....	Shaft....	....	56	P. Steel..	3 Plain.	Roller.	Roller...	2700	34x4	34x4
M. Disc...	Sel....	3	Unit....	Shaft..	....	56	P. Steel..	3 Plain.	Roller.	Roller...	2600	34x4	34x4
Int. Exp..	Sel....	4	Unit....	2 Chain..	133	56½	P. Steel..	Plain...	Ball...	Ball....	3600	36x4	37x5
Int. Exp..	Sel....	4	Unit....	2 Chain..	133	56½	P. Steel..	Plain...	Ball...	Ball....	3450	36x4½	36x4½
Int. Exp..	Sel....	4	Unit....	2 Chain.	112	56½	P. Steel..	Plain...	Ball...	Ball....	3000	36x4½	36x4½
Int. Exp..	Sel....	4	Unit....	2 Chain..	133	56½	P. Steel..	Plain...	Ball...	Ball....	3900	36x4	37x5
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Ball....	Ball...	Ball....	.....	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Ball....	Ball...	Ball....	.....	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Ball....	Ball...	Ball....	.....	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Ball....	Ball...	Ball....	.....	34x4	34x4
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Ball....	Ball...	Ball....	.....	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	Plain...	Ball...	Roller...	.....	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	Plain...	Ball...	Roller...	.....	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	Plain...	Ball...	Roller...	.....	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	Plain...	Ball...	Roller...	.....	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	Plain...	Ball...	Roller...	.....	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	Plain...	Ball...	Roller...	.....	36x4½	36x4½
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	Plain...	Ball...	Roller...	.....	36x4½	36x4½
Cone.....	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Plain...	Ball...	Roller...	.....	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Plain...	Ball...	Roller...	.....	34x4½	34x4½
Cone.....	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Plain...	Ball...	Roller...	.....	34x4½	34x4½
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	3pl.-2B.	Ball...	Ball....	2700	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	3pl.-2B.	Ball...	Ball....	2700	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	3pl.-2B.	Ball...	Ball....	2300	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	3pl.-2B.	Ball...	Ball....	2300	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	3 Plain.	Ball...	Ball....	3000	36x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	3 Plain.	Ball...	Ball....	3000	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	3 Plain.	Ball...	Ball....	3000	36x4	36x4
Disc......	Sel....	3	Motor...	Shaft....	108	56	P. Steel..	Plain...	Ball...	Ball....	2000	32x3½	32x3½
Disc......	Sel....	3	Motor...	Shaft....	108	56	P. Steel..	Plain...	Ball...	Ball....	2200	32x3½	32x3½
Disc......	Sel....	3	Motor...	Shaft....	114	56	P. Steel..	Plain...	Ball...	Ball....	2750	34x4	34x4
Disc......	Sel....	3	Motor...	Shaft....	124	56	P. Steel..	Plain...	Ball...	Ball....	3200	36x4	36x4
Cone.....	Sel....	3	Axle....	Shaft....	106	[3]56	P. Steel..	Plain...	Plain..	Roller...	2150	32x3½	32x3½
Cone.....	Sel....	2	Axle....	Shaft....	100	[3]56	P. Steel..	Plain...	Ball...	Roller...	1200	32x3	32x3
Cone.....	Sel....	3	Axle....	Shaft....	110	[3]56	P. Steel..	Plain...	Plain..	Roller...	2200	34x3½	34x3½
Cone.....	Sel....	3	Axle....	Shaft....	110	[3]56	P. Steel..	Plain ..	Plain..	Roller...	2200	34x3½	34x3½
Cone.....	Sel....	3	Axle....	Shaft....	110	[3]56	P. Steel..	Plain...	Plain..	Roller...	2200	34x3½	34x3½
Cone.....	Sel....	3	Axle....	Shaft....	110	[3]56	P. Steel..	Plain...	Plain..	Roller...	2200	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	100	56	Wood...	Plain...	Ball...	Ball....	1800	32x3½	32x4
M. Disc...	Sel....	3	Motor...	Shaft....	100	56	Wood...	Plain...	Ball...	Ball....	1850	32x3½	32x4
M. Disc...	Sel....	3	Motor...	Shaft....	108	56	Wood...	Plain...	Ball...	Roller...	2300	34x4	34x4½
M. Disc...	Sel....	3	Motor...	Shaft....	108	56	Wood...	Plain...	Ball...	Roller...	.....	34x4	34x4½
M. Disc...	Sel....	3	Motor...	Shaft....	108	56	Wood...	Plain...	Ball...	Roller...	.....	34x4	34x4½
M. Disc...	Sel....	3	Motor...	Shaft....	133	56	Wood...	Plain...	Ball...	Roller...	3300	37x5	38x5½
M. Disc...	Sel....	3	Motor...	Shaft....	126	56	Wood...	Plain...	Ball...	Roller...	3200	37x5	38x5½
M. Disc...	Sel....	3	Motor...	Shaft....	123	56	Wood...	Plain...	Ball...	Roller...	.....	36x4½	37x5
M. Disc...	Sel....	3	Motor...	Shaft....	123	56	Wood...	Plain...	Ball...	Roller...	2800	36x4½	37x5
M. Disc...	Sel....	3	Motor...	Shaft....	123	56	Wood...	Plain...	Ball...	Roller...	2700	36x4½	37x5
M. Disc...	Sel....	3	Motor...	Shaft....	123	56	Wood...	Plain...	Ball...	Roller...	.....	36x4½	37x5
M. Disc...	Sel....	3	Axle....	Shaft....	120	[3]56	P. Steel..	5 Plain.	5 Rol..	Rollers.	3400	36x4½	36x4½
M. Disc...	Sel....	3	Axle....	Shaft....	120	[3]56	P. Steel..	5 Plain.	5 Rol..	Roller...	3400	36x4	36x4
M. Disc. .	Sel....	3	Axle....	Shaft....	122	[3]56	P. Steel..	5 Plain.	5 Rol..	Roller...	3300	36x4	36x4
M. Disc...	Sel....	3	Axle....	Shaft. ..	122	[3]56	P. Steel..	5 Plain.	5 Rol..	Rollers.	3300	40x4	40x4
M. Disc...	Sel....	3	Axle....	Shaft....	120	[3]56	P. Steel..	5 Plain.	5 Rol..	Roller...	3350	36x4½	36x4½

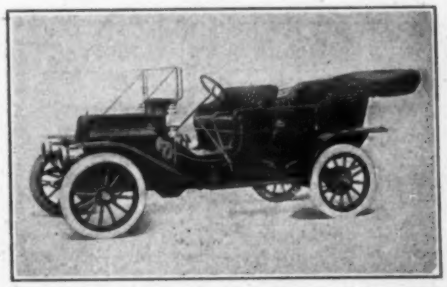
[3] Demi-tonneau. [4] Demi tonneau body, "Scout."

ELMORE—Elmore Mfg. Co., Clyde, O.
E-M-F—E-M-F Co., Detroit, Mich.
EVERITT—Metzger Motor Car Co., Detroit, Mich.
FRANKLIN—H. H. Franklin Mfg. Co., Syracuse, N. Y.
GLIDE—Bartholomew Co., Peoria, Ill.

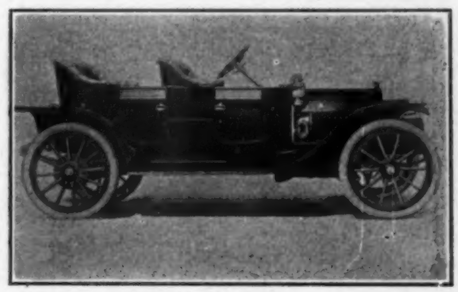
of a system of grouping it was possible to show examples of each type of power plant and to give the names of the makers employing them. In certain respects it will be found that there is a common basis for all of the power plants, as, for illustration, the high tension magneto ignition system is quite generally in use; there are very few examples of the low tension ignition system.



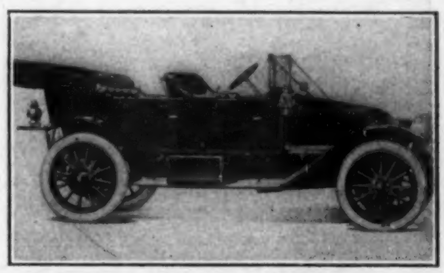
Elmore runabout



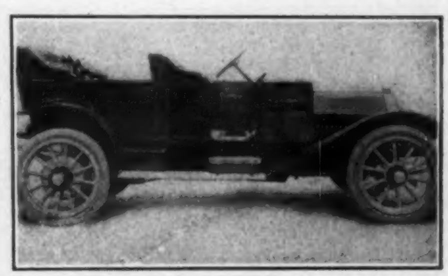
E-M-F "30" touring car



Everitt "30" fore-door close-coupled touring car

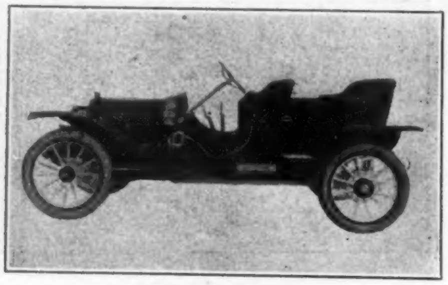


Franklin Model D 6-cylinder touring

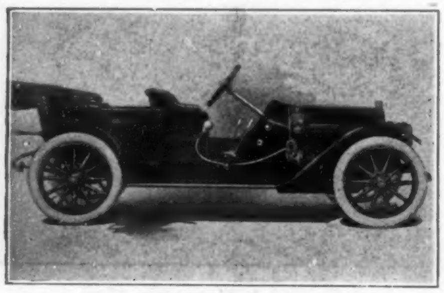


Glide fore-door touring car

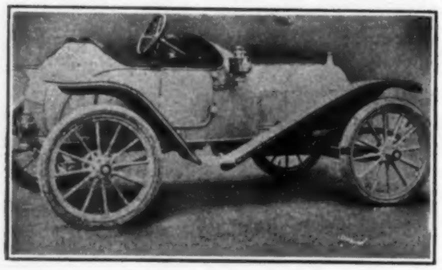
Details of Passenger Automobiles



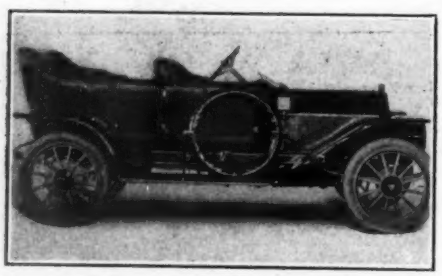
Haynes five-passenger touring car



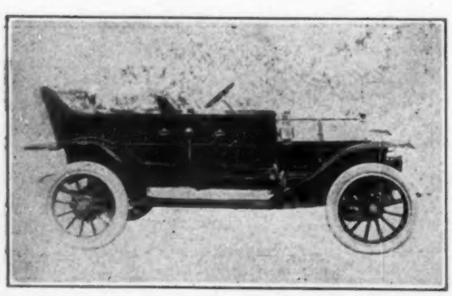
Hudson "30" touring car



Hupmobile two-seated torpedo



Inter-State flush-sided torpedo



Jackson Model 41, fore-door touring car

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY Type	BODY Seats	MOTOR Cyl.	MOTOR Bore Inches	MOTOR Stroke Inches	MOTOR Cyl. Cast	COOLING Radiator	COOLING Pump	IGNITION Magneto	IGNITION Battery	Lubrication
Haynes 20	$2000	28.9	Tour'g..	5	4	4¼	5	Pairs..	Cellular..	Gear..	H. T...	Dry....	Splash.
Haynes 20	2000	28.9	T. ton..	4	4	4¼	5	Pairs..	Cellular..	Gear..	H. T...	Dry....	Splash..
Haynes 20	2000	28.9	R'bout.	2	4	4¼	5	Pairs..	Cellular..	Gear..	H. T...	Dry....	Splash..
Haynes Y	3000	40.0	Tour'g..	7	4	5	5½	Pairs..	Cellular..	Gear..	H. T...	Storage	Pump..
Hudson "33"	1250	25.6	Tour'g..	5	4	4	4½	Block.	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Hudson "33"	1300	25.6	T. ton..	4	4	4	4½	Block.	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Hudson "33"	1350	25.6	Torp'o..	5	4	4	4½	Block.	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Hudson "25"	1000	22.5	R'ster..	3	4	3¾	4½	Block.	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Hupmobile	900	16.9	Tour'g..	4	4	3¼	3⅜	Pairs..	Tubular.	Syph'n	H. T...	None...	Splash..
Hupmobile	1100	16.9	Coupe..	3	4	3¼	3⅜	Pairs..	Tubular.	Syph'n	H. T...	None...	Splash..
Hupmobile	850	16.9	Torp'o..	2	4	3¼	3⅜	Pairs..	Tubular.	Syph'n	H. T...	None...	Splash..
Hupmobile	750	16.9	R'bout.	2	4	3¼	3⅜	Pairs..	Tubular.	Syph'n	H. T...	None...	Splash..
Inter-State 30 A	1750	32.4	Tour'g..	5	4	4½	5	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Inter-State 31 A	1750	32.4	D. ton..	4	4	4½	5	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Inter-State 32 A	1750	32.4	R'ster..	3	4	4½	5	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Inter-State 33A	1750	32.4	D r'ster	4	4	4½	5	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Inter-State 34	2000	32.4	Torp'o..	4	4	4½	5	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Inter-State 34 A	2000	32.4	Torp'o..	5	4	4½	5	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Inter-State 35 A	2700	32.4	Tour'g..	7	4	4½	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Jackson "51"	2200	36.1	Tour'g.	5	4	4¾	4¾	Single	Cellular..	Syph'n	H. T...	Dry....	Pump..
Jackson "51"	2200	36.1	Tour'bt	4	4	4¾	4¾	Single.	Cellular..	Syph'n	H. T...	Dry....	Pump..
Jackson "41"	1700	32.4	Tour'g..	5	4	4½	4½	Pairs..	H'comb..	Syph'n	H. T...	Dry....	Pump..
Jackson "41"	1700	32.4	Tour'bt	4	4	4½	4½	Pairs..	H'comb..	Syph'n	H. T...	Dry....	Pump..
Jackson "38"	1650	30.6	Torp'o..	4	4	4⅜	4½	Pairs..	H'comb .	Syph'n	H. T...	Dry....	Pump..
Jackson "30"	1250	25.6	Tour'g..	5	4	4	4	Pairs..	H'comb..	Syph'n	H. T...	Dry....	Pump..
Jackson "25"	1100	22.5	R'ster...	2	4	3¾	4½	Block.	H'comb..	Syph'n	H. T...	Dry....	Pump..
Kissel Kar LD-11	1500	28.9	Tour'g..	5	4	4¼	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar LD-11	1600	28.9	F'd.Tg..	5	4	4¼	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar LD-11	1500	28.9	B. ton..	4	4	4¼	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar LD-11	1600	28.9	S.racer.	2	4	4¼	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel KarD11&WS11	2000	38.0	Tour'g..	5	4	4⅞	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar D-11	2100	38.0	F'd.Tg..	5	4	4⅞	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar D11&WS 11	2000	38.0	B. ton..	4	4	4⅞	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar D-11	2100	38.0	S.racer.	2	4	4⅞	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar F-11	2500	48.6	Tour'g..	7	6	4½	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Diy....	Pump..
Kissel Kar F-11	2600	48.6	F'd.Tg..	7	6	4½	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar F-11	2500	48.6	B. ton..	4	4	4½	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar F-11	2600	48.6	S racer.	2	4	4½	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar G-11	3000	57.0	Tour'g..	7	6	4⅞	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar G-11	3100	57.0	F'd.Tg..	7	6	4⅞	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Kissel Kar G-11	3000	57.0	B. ton..	4	6	4⅞	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Knox R	3500	40.0	Tour'g..	[1]	4	5	4¾	Single.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox R	3300	40.0	Tour'g..	[1]	4	5	4¾	Single.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox R	4250	40.0	Limous.	7	4	5	4¾	Single.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox R	4250	40.0	Land't..	6	4	5	4¾	Single.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox R	3400	40.0	Torp'o..	4	4	5	4¾	Single.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox R	3350	40.0	Ton'te..	5	4	5	4¾	Single.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox R	3250	40.0	C.coupl.	5	4	5	4¾	Single.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox R	3300	40.0	Rac'b't.	2	4	5	4¾	Single	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox R	3200	40.0	Rac'b't.	2	4	5	4¾	Single.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox S	5000	60.0	Tour'g..	7	6	5	4¾	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox S	5000	60.0	Tour'g..	7	6	5	4¾	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox S	4900	60.0	C.coupl.	5	6	5	4¾	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox S	4900	60.0	B. ton..	5	6	5	4¾	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox S	5000	60.0	Torp'o..	6	6	5	4¾	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox S	4800	60.0	Rac'b't.	4	6	5	4¾	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox S	4800	60.0	Rac'b't.	4	6	5	4¾	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Knox S	6250	60.0	Limous.	7	6	5	4¾	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Lambert 44	1000	27.2	R'bout.	2	4	4⅛	4½	Block.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Lambert 55	1075	27.2	Surrey..	4	4	4⅛	4½	Block.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Lambert 77	1250	27.2	Tour'g..	4	4	4⅛	4½	Block.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Lambert 88	1350	27.2	Tour'g..	5	4	4⅛	4½	Block.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Lambert 100	1700	32.4	Tour'g..	5	4	4½	5	Single.	Tubular.	Gear..	H. T...	Dry....	Pump..
Lambert 101	1600	27.2	Torp'o..	4	4	4⅛	4½	Block.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Locomobile "L"	3500	30.0	Tour'g..	5	4	4½	4½	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	F.feed..
Locomobile "L"	4600	30.0	F'd.Lim	6	4	4½	4½	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	F.feed..
Locomobile "L"	3500	30.0	B.ton...	5	4	4½	4½	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	F.feed..
Locomobile "M"	4800	48.0	Tour'g..	7	6	4½	4½	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	F.feed..
Polished Chassis	......	48.0	Tour'g..	7	6	4½	4½	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..

[1] 5 or 7 passengers.

HAYNES—Haynes Automobile Co., Kokomo, Ind.
HUDSON—Hudson Motor Car Co., Detroit, Mich.
HUPMOBILE—Hupp Motor Car Co., Detroit, Mich.
INTER-STATE—Inter-State Automobile Co., Muncie, Ind.
JACKSON—Jackson Automobile Co., Jackson, Mich.

Don't tell the salesman how to build the automobile.

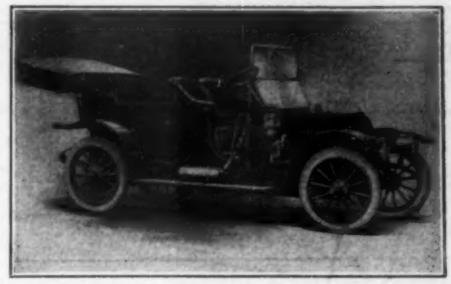
on the American Market for 1911

Clutch	Transmission: Type	Transmission: Speeds	Transmission: Location	Transmission: Drive	Wheelbase	Tread	Frame	Bearings: Crankshaft	Bearings: Trans-mis'n	Bearings: Axle	Weight	Tires: Front	Tires: Rear
Con.b'd	Sel.	3	Motor	Shaft	114	56	P. Steel	Plain	Roller	Roller	2400	34x4	34x4
Con.b'd	Sel.	3	Motor	Shaft	114	56	P. Steel	Plain	Roller	Roller	2400	34x4	34x4
Con.b'd	Sel.	3	Motor	Shaft	114	56	P. Steel	Plain	Roller	Roller	2400	34x4	34x4
Con.b'd	Sel.	3	Motor	Shaft	125	56	P. Steel	Plain	Roller	Roller	3400	36x4½	36x4½
Disc	Sel.	3	Motor	Shaft	114	48	P. Steel	Plain	Ball	Roller	2400	34x3½	34x3½
Disc	Sel.	3	Motor	Shaft	114	48	P. Steel	Plain	Ball	Roller	2350	34x3½	34x3½
Disc	Sel.	3	Motor	Shaft	114	48	P. Steel	Plain	Ball	Roller	2400	34x3½	34x3½
Cone	Sel.	3	Motor	Shaft	100	48	P. Steel	Plain	Plain	Roller	1700	32x3½	32x3½
10 pl. disc	Sel.	2	Motor	Shaft	110	56	P. Steel	Plain	Plain	Roller	1500	30x3	31x3½
10 pl. disc	Sel.	2	Motor	Shaft	86	56	P. Steel	Plain	Plain	Roller	1600	30x3	31x3½
10 pl. disc	Sel.	2	Motor	Shaft	86	56	P. Steel	Plain	Plain	Roller	1300	30x3	30x3
10 pl. disc	Sel.	2	Motor	Shaft	86	56	P. Steel	Plain	Plain	Roller	1200	30x3	30x3
M. Disc	Sel.	3	Unit	Shaft	118	56	P. Steel	3 Plain	Ball	Roller	...	34x4	34x4
M. Disc	Sel.	3	Unit	Shaft	118	56	P. Steel	3 Plain	Ball	Roller	...	34x4	34x4
M. Disc	Sel.	3	Unit	Shaft	118	56	P. Steel	3 Plain	Ball	Roller	...	34x4	34x4
M. Disc	Sel.	3	Unit	Shaft	118	56	P. Steel	3 Plain	Ball	Roller	...	34x4	34x4
M. Disc	Sel.	3	Unit	Shaft	118	56	P. Steel	3 Plain	Ball	Roller	...	34x4	34x4
M. Disc	Sel.	3	Unit	Shaft	118	56	P. Steel	3 Plain	Ball	Roller	...	34x4	34x4
M. Disc	Sel.	3	Unit	Shaft	118	56	P. Steel	3 Plain	Ball	Roller	...	34x4	34x4
M. Disc	Sel.	3	Motor	Shaft	120	[2]56	P. Steel	5 Plain	Ball	R. & B.	2800	36x4	36x4
M. Disc	Sel.	3	Motor	Shaft	120	[2]56	P. Steel	5 Plain	Ball	R. & B.	2800	36x4	36x4
M. Disc	Sel.	3	Motor	Shaft	110	[2]56	P. Steel	3 Plain	Ball	R. & B.	2400	34x4	34x4
M. Disc	Sel.	3	Motor	Shaft	110	[2]56	P. Steel	3 Plain	Ball	R. & B.	2400	34x4	34x4
M. Disc	Sel.	3	Motor	Shaft	115	[2]56	P. Steel	3 Plain	Ball	R. & B.	2450	34x4	34x4
M. Disc	Sel.	3	Motor	Shaft	105	[2]56	P. Steel	3 Plain	Ball	R. & B.	2000	32x3½	32x3½
M. Disc	Sel.	3	Unit	Shaft	105	[2]56	P. Steel	2 B.&pl	Ball	R. & B.	1850	32x3½	32x3½
Cone	Sel.	3	S. Frame	Shaft	116	56	P. Steel	Plain	Ball	Roller	...	34x4	34x4
Cone	Sel.	3	S. Frame	Shaft	116	56	P. Steel	Plain	Ball	Roller	...	34x4	34x4
Cone	Sel.	3	S. Frame	Shaft	116	56	P. Steel	Plain	Ball	Roller	...	34x4	34x4
Cone	Sel.	3	S. Frame	Shaft	...	56	P. Steel	Plain	Ball	Roller	...	Opt'al.	Opt'al.
Cone	Sel.	4	S. Frame	Shaft	124	56	P. Steel	Plain	Ball	Roller	...	36x4	36x4
Cone	Sel.	4	S. Frame	Shaft	124	56	P. Steel	Plain	Ball	Roller	...	36x4	36x4
Cone	Sel.	4	S. Frame	Shaft	124	56	P. Steel	Plain	Ball	Roller	...	36x4	36x4
Cone	Sel.	4	S. Frame	Shaft	124	56	P. Steel	Plain	Ball	Roller	...	Opt'al	Opt'al
Cone	Sel.	4	S. Frame	Shaft	132	56	P. Steel	Plain	Ball	Roller	...	36x4	36x4½
Cone	Sel.	4	S. Frame	Shaft	132	56	P. Steel	Plain	Ball	Roller	...	36x4	36x4½
Cone	Sel.	4	S. Frame	Shaft	132	56	P. Steel	Plain	Ball	Roller	...	40x4	40x4
Cone	Sel.	4	S. Frame	Shaft	132	56	P. Steel	Plain	Ball	Roller	...	Opt'al	Opt'al
Cone	Sel.	4	S. Frame	Shaft	142	56	P. Steel	Plain	Ball	Roller	...	36x4½	36x5
Cone	Sel.	4	S. Frame	Shaft	142	56	P. Steel	Plain	Ball	Roller	...	36x4½	36x5
Cone	Sel.	4	S. Frame	Shaft	142	56	P. Steel	Plain	Ball	Roller	...	40x4	40x4
3 Plate	Sel.	3	Motor	Shaft	122	56	P. Steel	Plain	Ball	Ball	3400	36x4½	36x4½
3 Plate	Sel.	3	Motor	Shaft	122	56	P. Steel	Plain	Ball	Ball	3400	36x4½	36x4½
3 Plate	Sel.	3	Motor	Shaft	122	56	P. Steel	Plain	Ball	Ball	3400	36x4½	36x4½
3 Plate	Sel.	3	Motor	Shaft	122	56	P. Steel	Plain	Ball	Ball	3400	36x4½	36x4½
3 Plate	Sel.	3	Motor	Shaft	122	56	P. Steel	Plain	Ball	Ball	3400	36x4½	36x4½
3 Plate	Sel.	3	Motor	Shaft	122	56	P. Steel	Plain	Ball	Ball	3400	36x4½	36x4½
3 Plate	Sel.	3	Motor	Shaft	122	56	P. Steel	Plain	Ball	Ball	3400	36x4½	36x4½
3 Plate	Sel.	3	Motor	Shaft	122	56	P. Steel	Plain'	Ball	Ball	3400	36x4½	36x4½
3 Plate	Sel.	3	Motor	Shaft	117	56	P. Steel	Plain	Ball	Ball	3400	36x4½	36x4½
Disc	Sel.	3	Motor	Shaft	134	56	P. Steel	Plain	Ball	Ball	3900	38x5½	38x5½
Disc	Sel.	3	Motor	Shaft	134	56	P. Steel	Plain	Ball	Ball	4000	38x5½	38x5½
Disc	Sel.	3	Motor	Shaft	134	56	P. Steel	Plain	Ball	Ball	3850	38x5½	38x5½
Disc	Sel.	3	Motor	Shaft	134	56	P. Steel	Plain	Ball	Ball	3850	38x5½	38x5½
Disc	Sel.	3	Motor	Shaft	134	56	P. Steel	Plain	Ball	Ball	4000	38x5½	38x5½
Disc	Sel.	3	Motor	Shaft	134	56	P. Steel	Plain	Ball	Ball	3600	38x5½	38x5½
Disc	Sel.	3	Motor	Shaft	134	56	P. Steel	Plain	Ball	Ball	3650	38x5½	38x5½
Disc	Sel.	3	Motor	Shaft	134	56	P. Steel	Plain	Ball	Ball	4400	38x5½	38x5½
None	Frict'n	...	Motor	Chain	102	56	P. Steel	Ball	Roller	Roller	1900	30x3½	30x3½
None	Frict'n	...	Motor	Chain	102	56	P. Steel	Ball	Roller	Roller	2000	30x3½	30x3½
None	Frict'n	...	Motor	Chain	106	56	P. Steel	Ball	Roller	Ball	2200	32x3½	32x3½
None	Frict'n	...	Motor	Chain	112	56	P. Steel	Ball	Roller	Ball	2300	32x3½	32x3½
None	Frict'n	...	Motor	Chain	115	56	P. Steel	Ball	Roller	Ball	2500	34x4	34x4
None	Frict'n	...	Motor	Chain	112	56	P. Steel	Ball	Roller	B. & R.	2400	33x4	33x4
Cone	Sel.	4	Unit	Shaft	120	54	P. Steel	Plain	Ball	Ball	...	34x4½	34x4½
Cone	Sel.	4	Unit	Shaft	120	54	P. Steel	Plain	Ball	Ball	...	34x4½	34x4½
Cone	Sel.	4	Unit	Shaft	120	54	P. Steel	Plain	Ball	Ball	...	34x4	34x4
M. Disc	Sel.	4	Unit	Shaft	135	54	P. Steel	Plain	Ball	Ball	...	36x4	37x5
M. Disc	Sel.	4	Unit	Shaft	135	54	P. Steel	Plain	Ball	Ball	...	36x4	37x5

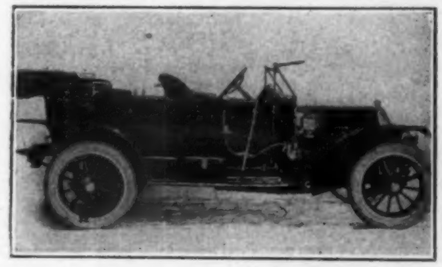
[2] Or 60 inches.

KISSEL KAR—Kissel Motor Car Co., Hartford, Wis.
KNOX—Knox Automobile Co., Springfield, Mass.
LAMBERT—Buckeye Mfg. Co., Anderson, Ind.
LOCOMOBILE—Locomobile Co. of America, Bridgeport, Conn.

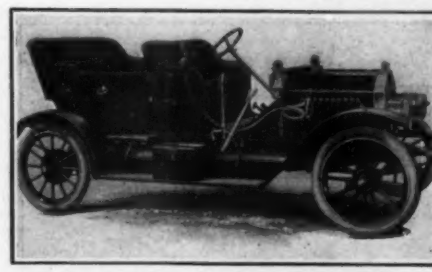
Don't take free advice from your "accommodating" friends.



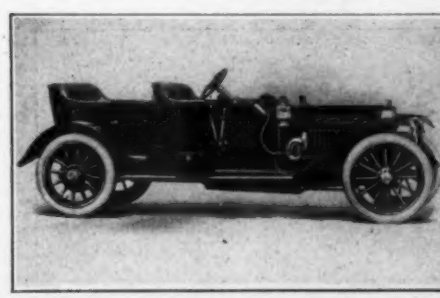
Kissel Kar with a touring body equipped complete



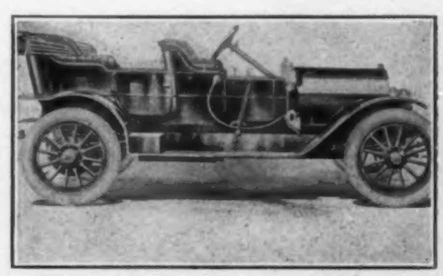
Knox 5-passenger torpedo



Lambert Model 88 5-passenger touring



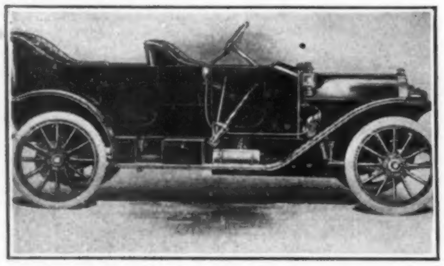
Locomobile Model M torpedo body touring car



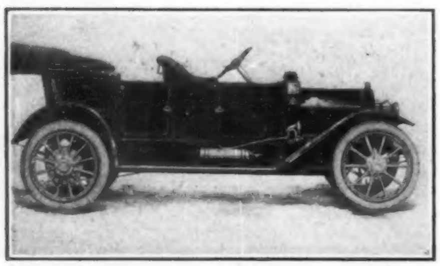
Mitchell Model T 5-passenger touring

Details of Passenger Automobiles

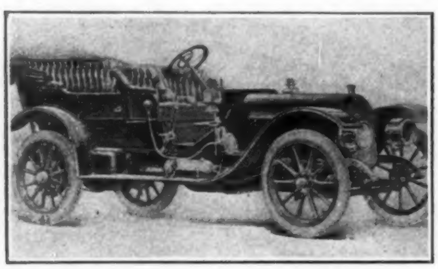
Lozier flush-sided torpedo



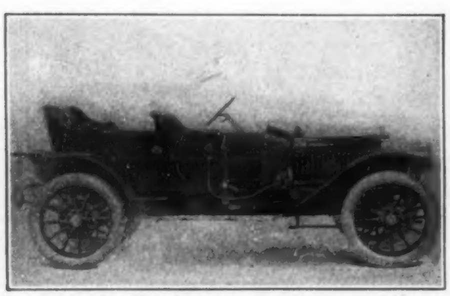
McIntyre 5-passenger touring car



Marmon "32" touring



Matheson 6-60 touring car



Maxwell Model G touring car

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY Type	BODY Seats	MOTOR Cyl.	MOTOR Bore inches	MOTOR Stroke inches	MOTOR Cyl. Cast	COOLING Radiator	COOLING Pump	IGNITION Magneto	IGNITION Battery	Lubrication
Lozier 51	$5500	51.6	Tour'g	7	6	4⅝	5½	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Splash..
Lozier 51	5500	51.6	B'clift..	5	6	4⅝	5½	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Splash..
Lozier 51	5500	51.6	L'wood.	5	6	4⅝	5½	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Splash..
Lozier 51	7000	51.6	Limous.	7	6	4⅝	5½	Pairs..	H'comb..	Cent'	H. T...	Storage	Splash..
Lozier 46	4600	46.0	Tour'g..	7	4	5⅜	6	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Splash..
Lozier 46	4600	46.0	B'clift..	5	4	5⅜	6	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Splash..
Lozier 46	4600	46.0	L'wood.	5	4	5⅜	6	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Splash..
Lozier 46	6000	46.0	Limous.	7	4	5⅜	6	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Splash..
McIntyre A-4	850	18.0	Tour'g..	4	2	4¾	4¾	Single.	Tubular.	Syph'n	H. T...	None...	Pump..
McIntyre A-5	1250	25.6	Tour'g..	5	4	4	4½	Single.	Tubular.	Syph'n	H. T...	None...	Pump..
McIntyre T-5	1150	25.6	T'bout..	2	4	4	4½	Single.	Tubular.	Syph'n	H. T...	None...	Pump..
McIntyre M-5	1650	32.4	Tour'g..	5	4	4½	5½	Single.	Tubular.	Cent'fl	H. T...	None...	Pump..
McIntyre T-1	1850	32.4	Torp'o..	5	4	4½	5¼	Single.	Tubular.	Cent'fl	H. T...	None...	Pump..
McIntyre XIV	1250	23.0	Extra..	2	2	5⅜	4¾	Single.	Tubular.	Gear..	H. T...	None...	Pump..
McIntyre XXIV	1950	27.2	Extra..	2	4	4½	3¾	Single.	Tubular.	Gear..	H. T...	Storage	Pump..
McIntyre 251	900	18.0	Extra..	2	2	4¾	4¾	Single.	Tubular.	Gear..	H. T...	None...	Pump..
McIntyre 251	800	18.0	Extra..	2	2	4¾	4¾	Single.	Air-cool..	None..	H. T...	None...	Pump..
Marmon "32"	2750	32.4	Tour'g..	5	4	4½	5	Pairs..	Cellular..	Cent'fl	H. T...	Storage	F. feed.
Marmon "32"	2750	32.4	Sub'n..	4	4	4½	5	Pairs..	Cellular..	Cent'fl	H. T...	Storage	F. feed.
Marmon "32"	2750	32.4	R'ster..	2	4	4½	5	Pairs..	Cellular..	Cent'fl	H. T...	Storage	F. feed.
Matheson Six 18	3500	48.6	Tour'g..	5	6	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Storage	Pump..
Matheson Six 19	3500	48.6	T. ton..	4	6	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Storage	Pump..
Matheson Six 20	3500	48.6	T'bout.	4	6	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Storage	Pump..
Matheson Six 21	3500	48.6	R'bout.	2	6	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Storage.	Pump..
Matheson Six 22	3500	48.6	C.coupe	4	6	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Storage	Pump..
Matheson Six 23	4700	48.6	Limous.	7	6	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Storage	Pump..
Matheson Six 24	4700	48.6	Land't..	7	6	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Storage	Pump..
Maxwell "E A"	1600	30.0	Tour'g..	5	4	4½	4½	Single.	H'comb.	Syph'n	H. T...	Dry....	Grav...
Maxwell "G A"	1600	30.0	Tour'g..	4	4	4½	4½	Single.	H'comb.	Syph'n	H. T...	Dry....	Grav...
Maxwell "I"	1100	25.0	Tour'g..	4	4	4	4	Pairs.	H'comb.	Syph'n	H. T...	Dry....	Grav...
Maxwell "Q"	900	22.0	R'bout.	2	4	3⅝	4	Pairs.	H'comb..	Syph'n	H. T...	Dry....	Grav...
Maxwell "A B"	600	14.0	R'bout.	2	2	4½	4	Single.	H'comb..	Syph'n	H. T...	Dry....	Grav...
Mercer 30-C	2150	28.9	T. ton..	4	4	4½	4½	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Pump..
Mercer 30-C	2150	28.9	Tour'g..	5	4	4½	4½	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Pump..
Mercer 35	2250	30.6	Racing.	2	4	4⅜	5	Pairs..	Cellular..	Cent'fl	H. T...	None...	Pump..
Mercer 35	2250	30.6	R'bout.	2	4	4⅜	5	Pairs..	Cellular..	Cent'fl	H. T...	None...	Pump..
Midland L-1	2000	32.4	Tour'g..	4	4	4½	5	Pairs..	H'comb..	Cent'fl	H. T...	Dry....	Splash..
Midland L-1	2000	32.4	T. ton..	5	4	4½	5	Pairs..	H'comb..	Cent'fl	H. T...	Dry....	Splash..
Midland L-1	1950	32.4	R'ster.	5	4	4½	5	Pairs..	H'comb..	Cent'fl	H. T...	Dry....	Splash..
Midland L-2	2100	32.4	R. T'g..	4	4	4½	5	Pairs..	H'comb..	Cent'fl	H. T...	Dry....	Splash..
Midland L-2	2100	32.4	F.d. T.t	7	4	4½	5	Pairs..	H.comb..	Cent'fl	H. T...	Dry....	Splash..
Midland K	2250	36.1	Tour'g..	5	4	4¾	5¼	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Midland K	2250	36.1	C. coupl	4	4	4¾	5¼	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Mitchell R	1200	28.9	Ru'ble..	3	4	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Pump..
Mitchell P T	1250	28.9	Surrey..	4	4	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Pump..
Mitchell T	1500	28.9	Tour'g..	5	4	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Pump..
Mitchell S	2250	43.4	Tour'g..	7	6	4½	5	Pairs.	Tubular.	Cent'fl	H. T...	Dry....	F. feed.
Moline M-35	1650	25.6	Tour'g..	5	4	4	6	Pairs..	Tubular.	None..	H. T...	Storage	Pump..
Moline M-35	1600	25.6	T. ton..	4	4	4	6	Pairs..	Tubular.	None..	H. T...	Storage	Pump..
Moon 30	1500	28.9	Tour'g.	5	4	4¼	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Moon 30	1500	28.9	T. ton..	4	4	4¼	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Moon 30	2750	28.9	Limous.	7	4	4¼	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Moon 30	1500	28.9	R'ster..	3	4	4¼	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Moon 30	2250	28.9	Coupe..	3	4	4¼	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Moon 45	3000	36.1	Tour'g.	7	4	4¾	5	Pairs..	H'comb..	Cent'fl	H. T...	Dry....	Mech...
Moon 45	3000	36.1	T. ton..	5	4	4¾	5	Pairs..	H'comb..	Cent'fl	H. T...	Dry....	Mech...
Moon 45	4000	36.1	Limous.	7	4	4¾	5	Pairs..	H'comb..	Cnet'fl	H. T...	Dry....	Mech...
Moon 45	3100	36.1	Fore-D.	7	4	4¾	5	Pairs..	H'comb..	Cent'fl	H. T...	Dry....	Mech...
Moon 45	3100	36.1	Torp'o..	4	4	4¾	5	Pairs..	H'comb..	Cent'fl	H. T...	Dry....	Mech...
National 40	2500	40.0	R'ster..	2	4	5	$5\frac{11}{16}$	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Pump..
National 40	2500	40.0	T. ton..	4	4	5	$5\frac{11}{16}$	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Pump..
National 40	2500	40.0	Tour'g..	5	4	5	$5\frac{11}{16}$	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Pump..
National 40	2600	40.0	T. ton.[1]	4	4	5	$5\frac{11}{16}$	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Pump..
National 40	2600	40.0	D.Tour.	5	4	5	$5\frac{11}{16}$	Pairs..	H'comb..	Cent'fl	H. T...	Storage	Pump..

[1]Fore-door Type.

LOZIER—Lozier Motor Co., Broadway & 56th St., New York, N. Y.
McINTYRE—W. H. McIntyre Co., Auburn, Ind.
MARMON—Nordyke-Marmon Co., Indianapolis, Ind.
MATHESON—Matheson Motor Car Co., Wilkes-Barre, Pa.
MAXWELL—Maxwell-Briscoe Motor Co., Tarrytown, N. Y.
MERCER—Mercer Automobile Co., Trenton, N. J.

Don't place too much store upon the color of the paint on car.

Don't let any man talk you into taking the car that will not suit your purpose.

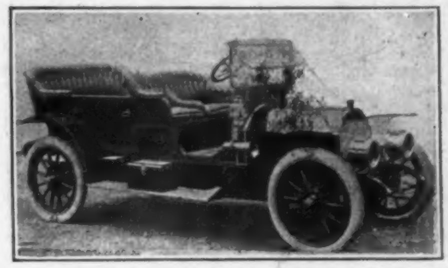
on the American Market for 1911

Clutch	TRANSMISSION Type	Speeds	Location	Drive	Wheelbase	Tread	Frame	BEARINGS Crankshaft	Transmis'n	Axle	Weight	TIRES Front	Rear
Disc......	Sel....	4	Unit....	Shaft....	131	56	Al. Steel.	Ball....	Ball...	Ball....	3655	36x4	36x5
Disc......	Sel....	4	Unit....	Shaft....	131	56	Al. Steel	Ball....	Ball...	Ball....	3450	36x4	36x5
Disc......	Sel....	4	Unit....	Shaft....	131	56	Al. Steel.	Ball....	Ball...	Ball....	3450	36x4	36x5
Disc......	Sel....	4	Unit....	Shaft....	131	56	Al. Steel.	Ball....	Ball...	Ball....	4375	36x4	36x5
Disc......	Sel....	4	Unit....	Shaft....	124	56	Al. Steel.	Ball....	Ball...	Ball....	3580	36x4	36x5
Disc......	Sel....	4	Unit....	Shaft	124	56	Al. Steel.	Ball....	Ball...	Ball....	3375	36x4	36x5
Disc......	Sel....	4	Unit....	Shaft....	124	56	Al. Steel.	Ball....	Ball...	Ball....	3375	36x4	36x5
Disc......	Sel....	4	Unit....	Shaft....	124	56	Al Steel.	Ball....	Ball...	Ball....	3400	36x4	36x5
M. Disc...	Plane..	2	Axle....	Shaft....	97	56	Angle St.	Plain...	Roller.	Roller...	1800	30x3	30x3
M. Disc...	Plane..	3	Axle....	Shaft....	110	56	P. Steel..	Plain...	Roller.	Roller...	2000	32x3	32x3
M. Disc...	Plane..	3	Axle....	Shaft....	110	56	P. Steel..	Plain...	Roller.	Roller...	1850	32x3	32x3
Cone......	Sel....	3	S. Frame	Shaft....	125	56	P. Steel..	Plain...	Ball...	Roller...	2100	36x3½	36x3½
Cone......	Sel....	3	S. Frame	Shaft....	125	56	P. Steel..	Plain...	Roller.	Roller...	2300	36x3½	36x3½
Cone......	Plane..	2	Unit....	Chain...	106	56	P. Steel..	Plain...	Plain..	Roller...	2000	34x2½	34x2½
M. Disc...	Plane..	2	Unit....	Chain...	120	56	P. Steel..	Plain...	Plain..	Roller...	3100	32x4	32x4
M. Disc...	Plane..	2	Unit....	Chain...	86	56	P. Steel..	Plain...	Plain..	Roller...	1600	34x1¾	34x2
M. Disc...	Plane..	2	Unit....	Chain...	86	56	P. Steel..	Plain...	Plain..	Roller...	1600	34x1¾	34x2
Cone.....	Sel....	3	Axle....	Shaft....	120	56½	P. Steel..	Plain...	Ball...	Roller...	2500	34x4	34x4
Cone.....	Sel..	3	Axle....	Shaft....	120	56½	P. Steel..	Plain...	Ball...	Roller...	2500	34x4	34x4
Cone.....	Sel....	3	Axle....	Shaft....	120	56½	P. Steel..	Plain...	Ball...	Roller...	2500	34x4	34x4
M. Disc...	Sel....	3	Axle....	Shaft....	125½	56	P. Steel..	Plain...	Ball...	B. &R.	3500	36x4	36x4
M. Disc...	Sel	3	Axle....	Shaft....	125½	56	P. Steel..	Plain...	Ball...	B. & R.	3400	36x4	36x4
M. Disc...	Sel	3	Axle....	Shaft....	125½	56	P. Steel..	Plain...	Ball...	B. & R.	3400	36x4	36x4
M. Disc...	Sel....	3	Axle....	Shaft....	125½	56	P. Steel..	Plain...	Ball...	B. & R.	3400	36x4	36x4
M. Disc...	Sel....	3	Axle....	Shaft....	125½	56	P. Steel..	Plain...	Ball...	B. & R.	3400	36x4	36x4
M. Disc...	Sel....	3	Axle....	Shaft....	125½	56	P. Steel..	Plain...	Ball...	B. & R.	3900	36x4	36x5
M. Disc...	Sel....	3	Axle....	Shaft....	125½	56	P. Steel..	Plain...	Ball...	B. & R.	3900	36x4	36x5
M. Disc...	Prog...	3	Motor...	Shaft....	110	56	P. Steel..	Plain...	Plain..	Roller...	.....	34x4	34x4
M. Disc...	Prog...	3	Motor...	Shaft....	110	56	P. Steel..	Plain...	Plain..	Roller...	.....	34x4	34x4
M. Disc...	Prog...	3	Motor...	Shaft....	104	56	P. Steel ..	Plain...	Plain..	B. & R.	.....	32x3½	32x3½
M. Disc...	Prog...	3	Motor...	Shaft....	93	56	P. Steel..	Plain...	Ball...	Ball....	.....	30x3½	30x3½
M. Disc...	Plane..	2	Motor...	Shaft....	86	56	P. Steel..	Plain ..	Plain..	Ball....	.....	28x3	28x3
Disc......	Sel....	3	S. Frame	Shaft....	116	56	Channel.	3 Plain.	Ball...	Ball....	2500	34x4	34x4
Disc......	Sel....	3	S. Frame	Shaft....	116	56	Channel.	3 Plain.	Ball...	Ball....	2700	34x4	34x4
Disc......	Sel....	3	S. Frame	Shaft....	108	56	Channel.	3 Plain.	Ball...	Ball....	2100	32x3½	32x4
Disc......	Sel....	3	S. Frame	Shaft....	108	56	Channel.	5 Plain.	Ball...	Ball....	2200	34x4	34x4
M. Disc...	Sel....	3	Unit.....	Shaft....	115	56	P. Steel..	Plain...	Ball ..	Ball....	2700	34x4	34x4
M. Disc...	Sel....	3	Unit.....	Shaft....	115	56	P. Steel..	Plain ...	Ball ..	Ball....	[illegible]	34x4	34x4
M. Disc...	Sel....	3	Unit.....	Shaft....	115	56	P. Steel..	Plain...	Ball ..	Ball....	2700	34x4	34x4
M. Disc...	Sel....	3	Unit.....	Shaft....	115	56	P. Steel..	Plain...	Ball ..	Ball....	2700	34x4	34x4
M. Disc...	Sel....	3	Unit.....	Shaft....	115	56	P. Steel..	Plain...	Ball ..	Ball....	[illegible]	34x4	34x4
M. Disc ..	Sel....	3	Unit.....	Shaft....	118	56	P. Steel..	Plain...	Roller.	Roller...	3000	36x4	36x4
M. Disc ..	Sel....	3	Unit.....	Shaft....	118	56	P. Steel..	Plain...	Roller.	Roller...	3000	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	100	56	Channel.	....	B. & R.	Semi Fl.	.....	32x3½	32x3½
Cone.....	Sel....	3	Unit....	Shaft....	100	56	Channel.	....	B. & R.	Semi Fl.	.....	32x3½	32x3½
Cone.....	Sel....	3	Unit....	Shaft....	115	56	Channel.	....	B. & R.	Full Fl.	.....	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	130	56	Channel.	....	B. & R.	Full Fl.	.....	36x4½	36x4½
Cone.....	Sel....	3	Motor...	Shaft....	112	56	Dr. St...	Plain...	Roller.	R. & B.	2400	36x3½	36x3½
Cone.....	Sel....	3	Motor...	Shaft....	112	56	Dr. St...	Plain...	Roller.	R. & B.	2400	36x3½	36x3½
M. Disc...	Sel....	3	Axle....	Shaft....	114	56	P. Steel..	3 Plain.	Roller.	Roller...	2650	34x3½	34x3½
M. Disc...	Sel....	3	Axle....	Shaft....	114	56	P. Steel..	3 Plain.	Roller.	Roller...	2650	34x3½	34x3½
M. Disc...	Sel....	3	Axle....	Shaft....	114	56	P. Steel ..	3 Plain.	Roller.	Roller...	2650	34x3½	34x4
M. Disc...	Sel....	3	Axle....	Shaft....	114	56	P. Steel..	3 Plain.	Roller.	Roller...	2650	34x3½	34x3½
M. Disc...	Sel....	3	Axle....	Shaft....	114	56	P. Steel..	3 Plain.	Roller.	Roller...	2650	34x3½	34x3½
M. Disc...	Sel....	4	Unit....	Shaft....	121	56	P. Steel..	Plain...	Plain..	Ball....	3100	36x4	36x4½
M. Disc...	Sel....	4	Unit....	Shaft....	121	56	P. Steel..	Plain...	Plain..	Ball....	3100	36x4	36x4
M. Disc...	Sel....	4	Unit....	Shaft....	121	56	P. Steel..	Plain...	Plain..	Ball....	3100	36x4	36x4½
M. Disc...	Sel....	4	Unit....	Shaft....	121	56	P. Steel..	Plain ...	Plain..	Ball....	3100	36x4	36x4½
M. Disc...	Sel....	4	Unit....	Shaft....	121	56	P. Steel..	Plain...	Plain ..	Ball....	3100	36x4	36x4
Cone.....	Sel	3	Unit....	Shaft....	124	56	P. Steel..	Plain...	Ball...	Roller...	2650	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	124	56	P. Steel..	Plain...	Ball...	Roller...	2800	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	124	56	P. Steel..	Plain...	Ball...	Roller...	2850	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	124	56	P. Steel..	Plain...	Ball...	Roller...	2800	36x4	36x4
Cone.....	Sel....	3	Unit....	Shaft....	124	56	P. Steel..	Plain...	Ball...	Roller...	2850	36x4	36x4

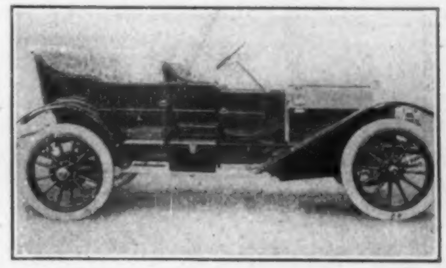
MIDLAND—Midland Motor Co., Moline, Ill.
MITCHELL—Mitchell-Lewis Motor Co., Racine, Wis.
MOLINE—Moline Automobile Co., East Moline, Ill.
MOON—Moon Motor Car Co., St. Louis, Mo.
NATIONAL—National Motor Vehicle Co., Indianapolis, Ind.

Don't ask the maker to kill harmony to suit you.

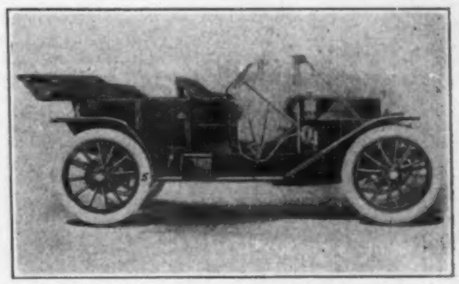
Don't forget that harmony must include a good relation of the machinery equipment.



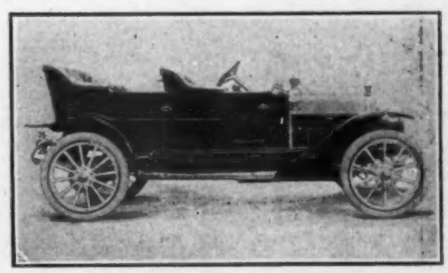
Mercer type 30 M touring car



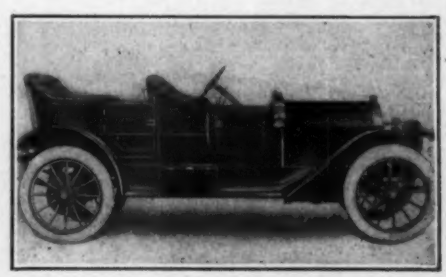
Midland Model L 2 touring car



Moline 35 H. P. 5-passenger touring

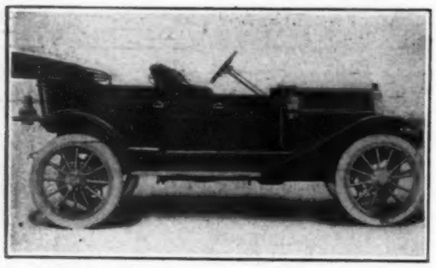


Moon fore-door 5-passenger touring

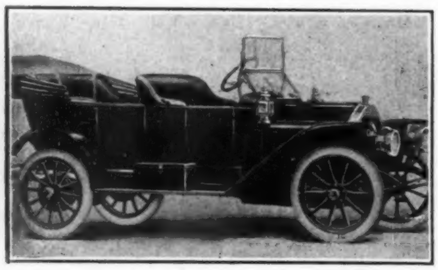


National "40" fore-door top tonneau

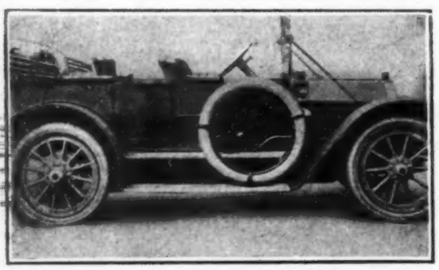
Details of Passenger Automobiles



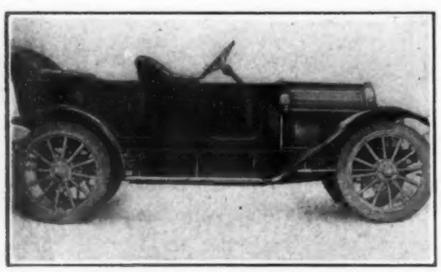
Oakland Model K fore-door 5-passenger



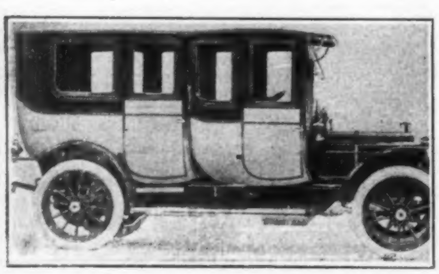
Ohio "40" 4-passenger torpedo



Oldsmobile fore-door autocrat model



Overland Model 51



Packard "30" fore-door limousine

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY		MOTOR				COOLING		IGNITION		Lubrication
			Type	Seats	Cyl.	Bore Inches	Stroke Inches	Cyl. Cast	Radi-ator	Pump	Mag-neto	Battery	
Oakland 33	$1200	25.6	Tour'g..	5	4	4	4	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Oakland 24	1000	25.6	R'bout.	2	4	4	4	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Oakland 25	1150	25.6	T. ton..	4	4	4	4	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Oakland K Special	1600	32.4	Tour'g..	5	4	2¼	5	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Oakland M Special	1500	32.4	R'bout.	2	4	4½	5	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Ohio Forty L	2450	32.4	Torp'o..	5	4	4½	4¾	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Ohio Forty A	2150	32.4	Tour'g..	5	4	4½	4¾	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Ohio Forty K	2150	32.4	R'ster..	3	4	4½	4¾	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Ohio Forty B	2150	32.4	Coupe..	4	4	4½	4¾	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Special	3000	36.0	Tour'g..	7	4	4¾	4¾	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Special	3000	36.0	R'ster..	2	4	4¾	4¾	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Special	3000	36.0	Cl. Coup	4	4	4¾	4¾	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Special	4200	36.0	Limous.	7	4	4¾	4¾	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Autocrat	3500	40.0	Tour'g..	7	4	5	6	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Autocrat	3500	40.0	Tour'g..	5	4	5	6	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Autocrat	3500	40.0	R'ster..	2	4	5	6	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Olpsmobile Autocrat	3500	40.0	T'bout..	4	4	5	6	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Autocrat	5000	40.0	Limous.	7	4	5	6	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Limited	5000	60.0	Tour'g..	7	6	5	6	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Limited	5000	60.0	T'bout..	4	6	5	6	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Limited	5000	60.0	R'ster..	2	6	5	6	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Oldsmobile Limited	7000	60.0	Limous.	7	6	5	6	Pairs..	H'comb..	Cent 'fl	H. T....	Dry....	Splash..
Overland 38	1000	22.5	Any....	4	4	3¾	4½	Single.	H'comb..	Syph'n	H. T...	Dry....	Mech...
Overland 40	1200	28.9	R'bout.	4	4	4¼	4½	Single.	H'comb..	Syph'n	H. T...	Dry....	Mech...
Overland 41	1300	28.9	[1]Tour'g.	5	4	4¼	4½	Single.	H'comb..	Syph'n	H. T...	Dry....	Mech...
Overland 42	1400	28.9	Tour'g..	5	4	4¼	4½	Single.	H'comb..	Syph'n	H. T...	Dry....	Mech...
Overland 45	775	19.6	R'bout.	2	4	3½	4½	Single.	H'comb..	Syph'n	H. T...	Dry....	Mech...
Overland 46	850	19.6	Torp'o..	2	4	3½	4½	Single.	H'comb..	Syph'n	H. T...	Dry....	Mech...
Overland 49	1095	22.5	Any....	4	4	3¾	4½	Single.	H'comb..	Syph'n	H. T...	Dry....	Mech...
Overland 50	1250	25.6	Torp'o..	2	4	4	4½	Single.	H'comb..	Syph'n	H. T...	Dry....	Mech...
Overland 51	1250	25.6	Tour'g..	5	4	4	4½	Single.	H'comb..	Syph'n	H. T...	Dry....	Mech...
Overland 52	1600	28.9	Tour'g..	5	4	4¼	4½	Single.	H'comb..	Syph'n	H. T...	Storage	Splash..
Overland 53	1600	28.9	T'bout..	2	4	4¼	4½	Single.	H'comb..	Syph'n	H. T...	Storage	Splash..
Overland 54	1675	28.9	T. ton..	4	4	4¼	4½	Single.	H'comb..	Syph'n	H. T...	Storage	Splash..
Packard "18"	3200	26.5	Tour'g..	5	4	4 1/16	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "18"	3200	26.5	C.coupl.	5	4	4 1/16	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "18"	4400	26.5	Limous.	5	4	4 1/16	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "18"	4600	26.5	F.d.Li..	5	4	4 1/16	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "18"	4500	26.5	Land't..	5	4	4 1/16	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "18"	4700	26.5	F.d.Ld.	5	4	4 1/16	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "18"	3200	26.5	R'bout.	2	4	4 1/16	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "18"	3900	26.5	Coupe...	2	4	4 1/16	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "30"	4200	40.0	Tour'g..	7	4	5	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "30"	4200	40.0	C.coupl.	5	4	5	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "30"	4200	40.0	Phaet..	5	4	5	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "30"	5450	40.0	Limous.	7	4	5	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "30"	5650	40.0	F.d.Li..	7	4	5	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "30"	5550	40.0	Land't..	7	4	5	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "30"	5750	40.0	F.d.Ld.	7	4	5	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "30"	4200	40.0	R'bout.	2	4	5	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Packard "30"	4900	40.0	Coupe..	2	4	5	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Palmer-Singer 6-60	4200	57.0	Tour'g..	7	6	4¾	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	F.feed..
Palmer-Singer 4-50	3500	48.4	Tour'g..	5	4	5½	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	F.feed..
Palmer-Singer 6-40	3300	38.4	Tour'g..	5	6	4	4¾	Block.	H'comb..	Cent 'fl	H. T...	Dry....	F.feed
Palmer-Singer 6-40	4050	38.4	Limous.	5	4	4	4¾	Block.	H'comb..	Cent 'fl	H. T...	Dry,...	F.feed..
Palmer-Singer 4-30	3750	28.9	Land't..	5	4	4½	4½	Pairs..	H'comb..	Cent 'fl	H. T...	None...	Pump..
Peerless "29"	4200	25.6	Limous.	6	4	4	4¾	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "29"	4300	25.6	Land't..	6	4	4	4¾	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "31"	4300	40.0	Tour'g..	7	4	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "31"	4300	40.0	C.coupl.	5	4	4	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "31"	4300	40.0	R'ster...	5	4	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "31"	4300	40.0	Phaet..	2	4	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "31"	4300	40.0	T'ton...	4	4	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "31"	4300	40.0	Torp'o..	4	4	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "31"	5400	40.0	Limous.	7	4	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "31"	5500	40.0	Land't..	7	4	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "31"	4800	40.0	D.lim...	7	4	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "32"	6000	60.0	Tour'g..	7	6	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "32"	6000	60.0	C.coupl.	5	6	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "32"	6000	60.0	R'ster..	5	6	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "32"	6000	60.0	Phaet..	2	6	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "32"	6000	60.0	P. ton..	4	6	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "32"	6000	60.0	Torp'o..	4	6	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "32"	7000	60.0	Limous.	7	6	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "32"	7100	60.0	Land't..	7	6	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..
Peerless "32"	6500	60.0	D.lim...	7	6	5	5½	Pairs..	Tubular.	Gear..	H. T...	Storage	Pump..

[1] Or Close-coupled.

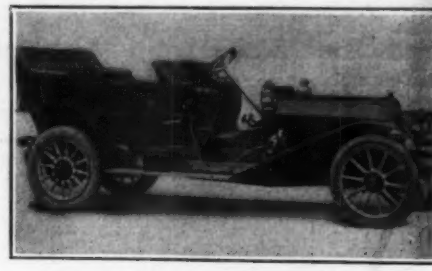
OAKLAND—Oakland Motor Car Co., Pontiac, Mich.
OHIO—Ohio Motor Car Co., Carthage, O.
OLDSMOBILE—Olds Motor Works, Lansing, Mich.
OVERLAND—Willys-Overland Co., Toledo, O.

on the American Market for 1911

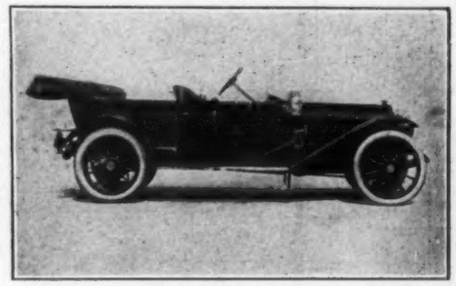
Clutch	TRANSMISSION				Wheelbase	Tread	Frame	BEARINGS			Weight	TIRES	
	Type	Speeds	Location	Drive				Crankshaft	Trans-mis'n	Axle		Front	Rear
M. Disc.	Sel.	4	Unit	Shaft	100	56	Channel.	3 Plain.	B.&Pl.	R. & B.	1300	32x3½	32x3½
M. Disc.	Sel.	4	Unit	Shaft	96	56	Channel.	3 Plain.	B.&Pl.	R. & B.	1200	32x3½	32x3½
M. Disc.	Sel.	4	Unit	Shaft	96	56	Channel.	3 Plain.	B.&Pl.	R. & B.	1200	32x3½	32x3½
M. Disc.	Sel.	4	Unit	Shaft	112	56	Channel.	3 Plain.	B.&Pl.	R. & B.	2500	34x4	34x4
M. Disc.	Sel.	4	Unit	Shaft	112	56	Channel.	3 Plain.	B.&Pl.	R. & B.	2350	34x4	34x4
5 Pl. Disc.	Sel.	3	Unit	Shaft	115	56	P. Steel.	Plain	Ball	Ball	2850	34x4	34x4
5 Pl. Disc.	Sel.	3	Unit	Shaft	115	56	P. Steel.	Plain	Ball	Ball	2850	34x4	34x4
5 Pl. Disc.	Sel.	3	Unit	Shaft	115	56	P. Steel.	Plain	Ball	Ball	2850	34x4	34x4
5 Pl. Disc.	Sel.	3	Unit	Shaft	115	56	P. Steel.	Plain	Ball	Ball	2850	34x4	34x4
Cone	Sel.	4	Unit	Shaft	118	56	P. Steel.	Plain	Plain	Ball		36x4	36x4
Cone	Sel.	4	Unit	Shaft	118	56	P. Steel.	Plain	Plain	Ball		36x4	36x4
Cone	Sel.	4	Unit	Shaft	118	56	P. Steel.	Plain	Plain	Ball		36x4	36x4
Cone	Sel.	4	Unit	Shaft	118	56	P. Steel.	Plain	Plain	Ball		36x4	36x4
Cone	Sel.	4	Unit	Shaft	124	56	P. Steel.	Plain	Roller.	Ball		38x4½	38x4½
Cone	Sel.	4	Unit	Shaft	124	56	P. Steel.	Plain	Roller.	Ball		38x4½	38x4½
Cone	Sel.	4	Unit	Shaft	124	56	P. Steel.	Plain	Roller.	Ball		38x4½	38x4½
Cone	Sel.	4	Unit	Shaft	124	56	P. Steel.	Plain	Roller.	Ball		38x4½	38x4½
Cone	Sel.	4	Unit	Shaft	124	56	P. Steel.	Plain	Roller.	Ball		38x4½	38x4½
Cone	Sel.	4	Unit	Shaft	138	56	P. Steel.	Plain	Roller.	Ball		42x4½	42x4½
Cone	Sel.	4	Unit	Shaft	138	56	P. Steel.	Plain	Roller.	Ball		42x4½	42x4½
Cone	Sel.	4	Unit	Shaft	138	56	P. Steel.	Plain	Roller.	Ball		42x4½	42x4½
Cone	Sel.	4	Unit	Shaft	138	56	P. Steel.	Plain	Roller.	Ball		42x4½	42x4½
M. Disc.	Plane.	2	Axle	Shaft	102	[2]56	P. Steel.	5 Plain.	Ball	Ball		32x3½	32x3½
M. Disc.	Plane.	2	Axle	Shaft	112	[2]56	P. Steel.	5 Plain.	Ball	Ball		34x3½	34x3½
M. Disc.	Plane.	2	Axle	Shaft	112	[2]56	P. Steel.	5 Plain.	Ball	Ball		34x4	34x4
Cone	Sel.	3	Axle	Shaft	112	[2]56	P. Steel.	5 Plain.	Ball	Ball		34x4	34x4
M. Disc.	Plane.	2	Axle	Shaft	96	56	P. Steel.	5 Plain.	Ball	Ball		32x3	32x3
M. Disc.	Plane.	2	Axle	Shaft	96	56	P. Steel.	5 Plain.	Ball	Ball		32x3	32x3
Cone	Sel.	3	Axle	Shaft	102	[2]56	P. Steel.	5 Plain.	Ball	Ball		32x3½	32x3½
Cone	Sel.	3	Axle	Shaft	110	56	P. Steel.	5 Plain.	Ball	Ball		34x3½	34x3½
Cone	Sel.	3	Axle	Shaft	110	[2]56	P. Steel.	5 Plain.	Ball	Ball		34x3½	34x3½
Cone	Sel.	3	Axle	Shaft	118	[2]56	P. Steel.	5 Plain.	Ball	Ball		34x4	34x4
Cone	Sel.	3	Axle	Shaft	118	56	P. Steel.	5 Plain.	Ball	Ball		34x4	34x4
Cone	Sel.	3	Axle	Shaft	118	56	P. Steel.	5 Plain.	Ball	Ball		34x4	34x4
Plate	Sel.	3	Axle	Shaft	112	56½	P. Steel.	Plain	Ball	Ball	3000	34x4	34x4
Plate	Sel.	3	Axle	Shaft	112	56½	P. Steel.	Plain	Ball	Ball	3000	34x4	34x4
Plate	Sel.	3	Axle	Shaft	112	56½	P. Steel.	Plain	Ball	Ball	3225	34x4	34x4
Plate	Sel.	3	Axle	Shaft	112	56½	P. Steel.	Plate	Ball	Ball	3300	34x4	34x4
Plate	Sel.	3	Axle	Shaft	112	56½	P. Steel.	Plate	Ball	Ball	3225	34x4	34x4
Plate	Sel.	3	Axle	Shaft	112	56½	P. Steel.	Plain	Ball	Ball	3300	34x4	34x4
Plate	Sel.	3	Axle	Shaft	102	56½	P. Steel.	Plain	Ball	Ball	2850	34x4	34x4
Plate	Sel.	3	Axle	Shaft	102	56½	P. Steel.	Plain	Ball	Ball	3000	34x4	34x4
Plate	Sel.	3	Axle	Shaft	123½	56½	P. Steel.	Plain	Ball	Ball	3650	36x4½	36x4½
Plate	Sel.	3	Axle	Shaft	123½	56½	P. Steel.	Plain	Ball	Ball	3650	36x4½	36x4½
Plate	Sel.	3	Axle	Shaft	123½	56½	P. Steel.	Plain'	Ball	Ball	3525	36x4½	36x4½
Plate	Sel.	3	Axle	Shaft	123½	56½	P. Steel.	Plain	Ball	Ball	3825	36x4½	36x4½
Plate	Sel.	3	Axle	Shaft	123½	56½	P. Steel.	Plain	Ball	Ball	3950	36x4½	36x4½
Plate	Sel.	3	Axle	Shaft	123½	56½	P. Steel.	Plain	Ball	Ball	3825	36x4½	36x4½
Plate	Sel.	3	Axle	Shaft	123½	56½	P. Steel.	Plain	Ball	Ball	3950	36x4½	36x4½
Plate	Sel.	3	Axle	Shaft	108	56½	P. Steel.	Plain	Ball	Ball	3325	36x4½	36x4½
Plate	Sel.	3	Axle	Shaft	108	56½	P. Steel.	Plain	Ball	Ball	3525	36x4½	36x4½
M. Disc.	Sel.	4	Unit	Shaft	138	56	P. Steel.	Plain	Ball	Ball	3700	36x4	36x5
M. Disc.	Sel.	4	Unit	Shaft	129	56	P. Steel.	Plain	Ball	Ball	3500	36x4	36x5
M. Disc.	Sel.	4	Unit	Shaft	126	56	P. Steel.	Plain	Ball,	Ball	3400	36x4	36x4½
M. Disc.	Sel.	4	Unit	Shaft	120	56	P. Steel.	Plain	Ball	Ball	3400	36x4	34x4
M. Disc.	Sel.	4	Unit	Shaft	120	56	P. Steel.	Plain	Ball	Ball	3300	36x4	34x4
Exp. b'd.	Sel.	4	Unit	Shaft	113	56	P. Steel.	Plain	Ball	Ball		34x4½	34x4
Exp. b'd.	Sel.	4	Unit	Shaft	113	56	P. Steel.	Plain	Ball	Ball		34x4½	34x4½
Exp. b'd.	Sel.	4	Unit	Shaft	123	56	P. Steel.	Plain	Ball	Ball		36x4	36x5
Exp. b'd.	Sel.	4	Unit	Shaft	123	56	P. Steel.	Plain	Ball	Ball		36x4	36x5
Exp. b'd.	Sel.	4	Unit	Shaft	119½	56	P. Steel.	Plain	Ball	Ball		36x4	36x5
Exp. b'd.	Sel.	4	Unit	Shaft	119½	56	P. Steel.	Plain	Ball	Ball		36x4	36x5
Exp. b'd.	Sel.	4	Unit	Shaft	119½	56	P. Steel.	Plain	Ball	Ball		36x4	36x5
Exp. b'd.	Sel.	4	Unit	Shaft	123	56	P. Steel.	Plain	Ball	Ball		36x4	36x5
Exp. b'd.	Sel.	4	Unit	Shaft	123	56	P. Steel.	Plain	Ball	Ball		36x4	36x5
Exp. b'd.	Sel.	4	Unit	Shaft	123	56	P. Steel.	Plain	Ball	Ball		36x4	36x5
Exp. b'd.	Sel.	4	Unit	Shaft	123	56	P. Steel.	Plain	Ball	Ball		36x4	36x5
Exp. b'd.	Sel.	4	Unit	Shaft	136	56	P. Steel.	Plain	Ball	Ball		36x4½	37x5
Exp. b'd.	Sel.	4	Unit	Shaft	136	56	P. Steel.	Plain	Ball	Ball		36x4½	37x5
Exp. b'd.	Sel.	4	Unit	Shaft	132½	56	P. Steel.	Plain	Ball	Ball		36x4½	37x5
Exp. b'd.	Sel.	4	Unit	Shaft	132½	56	P. Steel.	Plain	Ball	Ball		36x4½	37x5
Exp. b'd.	Sel.	4	Unit	Shaft	132½	56	P. Steel.	Plain	Ball	Ball		36x4½	37x5
Exp. b'd.	Sel.	4	Unit	Shaft	136	56	P. Steel.	Plain	Ball	Ball		36x4½	37x5
Exp. b'd.	Sel.	4	Unit	Shaft	136	56	P. Steel.	Plain	Ball	Ball		36x4½	37x5
Exp. b'd.	Sel.	4	Unit	Shaft	136	56	P. Steel.	Plain	Ball	Ball		36x4½	37x5
Exp. b'd.	Sel.	4	Unit	Shaft	136	56	P. Steel.	Plain	Ball	Ball		36x4½	37x5

[2]Or 60 Inches.

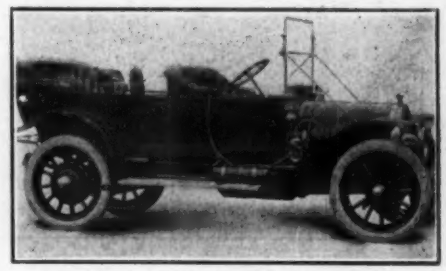
PACKARD—Packard Motor Car Co., Detroit, Mich.
SINGER—Palmer & Singer Mfg. Co., 1620 Broadway, New York
PEERLESS—Peerless Motor Car Co., Cleveland, O.



Palmer-Singer 6-60 touring car

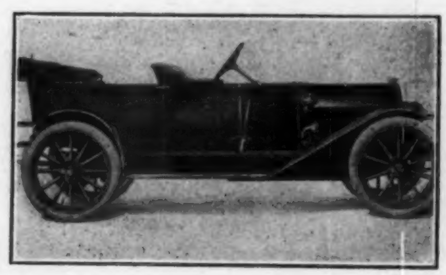


Peerless torpedo type of touring car



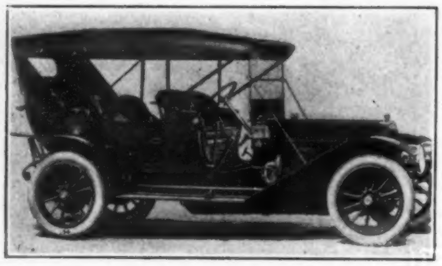
Rainier Model G 50 H. P. touring car

Royal Tourist fore-door touring car

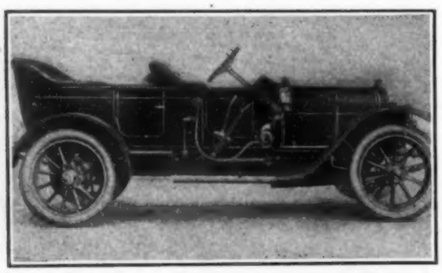


Sampson "35" torpedo

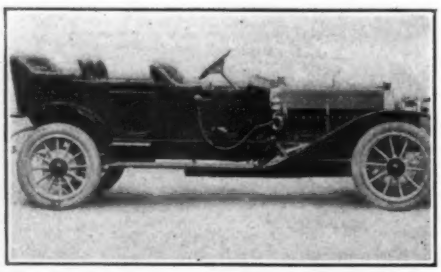
Details of Passenger Automobiles



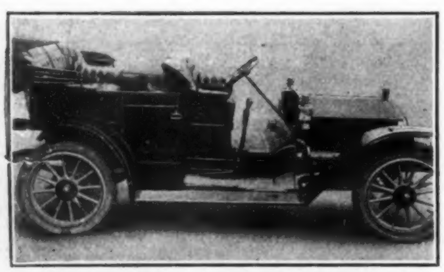
Pierce-Arrow 6-60 touring car



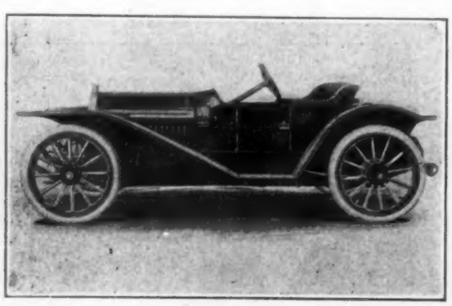
Pope-Hartford Model W touring car



Premier 7-passenger touring car



Pullman Model K touring car



Side view of the Regal "20" roadster

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY		MOTOR				COOLING		IGNITION		Lubrication
			Type	Seats	Cyl.	Bore Inches	Stroke Inches	Cyl. Cast	Radiator	Pump	Magneto	Battery	
Pierce-Arrow 36-T	$4000	38.4	Tour'g..	5	6	4	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Gravity
Pierce-Arrow 48-T	5000	48.6	Tour'g..	7	6	4½	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Grav'ty
Pierce-Arrow 66-T	6000	66.2	Tour'g..	7	6	5¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Grav'ty
Pope-Hartford	3000	36.1	Tour'g..	5	4	4¾	5½	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	3000	36.1	P. ton..	4	4	4¾	5½	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	3000	36.1	R'ster..	4	4	4¾	5½	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	3000	36.1	Torp'o..	4	4	4¾	5½	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	3250	36.1	Tour'g..	7	4	4¾	5½	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	4150	36.1	Limous.	5	4	4¾	5½	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	4150	36.1	Land't..	5	4	4¾	5½	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	4000	44⅝	Tour'g..	7	6	4 5/16	5⅝	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	4000	44⅝	R'ster..	4	6	4 5/16	5⅝	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	4000	44⅝	P.ton...	4	6	4 5/16	5⅝	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	4000	44⅝	Torp'o..	4	6	4 5/16	5⅝	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	5150	44⅝	Limous.	7	6	4 5/16	5⅝	Pairs..	Tubular.	Cent 'fl	H. T...	....	Pump..
Pope-Hartford	5150	44⅝	Land't..	7	6	4 5/16	5⅝	Pairs...	Tubular.	Cent 'fl	H. T...	....	Pump..
Premier 4-40	3000	32.6	[1]Tour'g.	4	4	4½	5¼	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Premier 4-40	3050	32.6	[1]Tour'g.	5	4	4½	5¼	Pairs..	Cellular..	Cent 'fl	L. T....	None...	Pump..
Premier 4-40	3100	32.6	[1]Tour'g.	7	4	4½	5¼	Pairs..	Cellular..	Cent 'fl	L. T....	Dry....	Pump..
Premier 4-40	4200	32.6	Limous	[2]5	4	4½	5¼	Pairs .	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Premier 4-40	2800	32.6	R's'er..	[2]2	4	4½	5¼	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Premier 6-60	3500	48.6	Club'm..	2	6	4½	5¼	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Premier 6-60	3600	48.6	R'ster..	3	6	4½	5¼	Pairs..	Cellular..	Cent 'fl	L. T....	Dry....	Pump..
Premier 6-60	3650	48.6	Tour'g..	7	6	4½	5¼	Pairs..	Cellular..	Cent 'fl	L. T....	Dry....	Pump..
Premier 6-60	5000	48.6	Limous.	7	6	4½	5¼	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..
Pullman O-11	1650	26.0	Tour'g..	4	4	4 1/32	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
Pullman O-11	1650	26.0	R'ster..	3	4	4 1/32	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
Pullman O-11	1650	26.0	T. ton..	2	4	4 1/32	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
Pullman M-11	3500	44.1	Tour'g..	7	4	5¼	6	Single.	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Pullman M-11	3500	44.1	T. ton..	2	4	5¼	6	Single.	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Pullman K-11	2000	32.4	Tour'g..	7	4	4½	4¾	Single.	Tubular.	Cent 'fl	H. T...	Storage	Pump..
Pullman K-11	2000	32.4	R'ster..	3	4	4½	4¾	Single.	Tubular.	Cent 'fl	H. T...	Storage	Pump..
Pullman K-11	2000	32.4	T. ton..	4	4	4½	4¾	Single.	Tubular.	Cent 'fl	H. T...	Storage	Pump..
Rainier H-7	.....	40.0	Torp'o..	4	4	5	5½	Pairs..	H'comb..	Sn Fan	H. T...	None...	Splash..
Rainier H-4	.....	40.0	Torp'o..	4	4	5	5½	Pairs..	H'comb..	Sn Fan	H. T...	None...	Splash..
Rainier G	.....	40.0	Torp'o..	4	4	5	5½	Pairs..	H'comb..	Sn Fan	H. T...	None...	Splash..
Regal N	900	22.5	R'ster..	2	4	3¾	4½	Block.	Tubular.	Th.-Si.	H. T...	Dry....	P. & S.
Regal Y	1250	25.6	Tour'g..	5	4	4	4	Pairs..	Tubular.	Th.-Si.	H. T...	Dry....	P. & S.
Regal S	1750	32.4	Tour'g..	7	4	4½	5	Pairs..	Tubular.	Th.-Si.	H. T...	Dry....	P. & S.
Reo R	1250	25.6	Tour'g..	5	4	4	4½	Pairs..	I'comb..	Cent 'fl	H. T...	Dry....	F.feed..
Reo S	1250	25.6	Tour'g..	5	4	4	4½	Pairs..	I'comb..	Cent 'fl	H. T...	Dry....	F feed..
Reo K	850	22.5	R'bout.	2	4	3¾	4½	Pairs..	I'comb..	Cent 'fl	H. T...	Dry....	F.feed..
Royal Tourist M-3	4500	48.4	Option'l	..	4	5½	6	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
S. G. V. "A"	2500	22.5	Tour'g..	5	4	3¾	4⅝	Block.	Cellular..	Cent 'fl	H. T...	None...	Pump..
S.G.V. "B"	2500	22.5	R'bout.	2	4	3¾	4⅝	Block.	Cellular..	Cent 'fl	H. T...	None...	Pump..
Selden 40-R	2500	22.1	R's'er..	2	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Splash..
Selden 44	2500	36.1	F.d.Rr..	4	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Sp ash..
Selden 46	2600	36.1	F.d.Tg..	6	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Splash..
Selden 40-S	2600	36.1	F.d.Tg..	7	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Splash..
Selden 40-T	2250	36.1	Tour'g..	5	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Splash..
Simplex 1910	4450	53.0	Extra..	..	4	5¾	5¾	Pairs..	H'comb..	Cent 'fl	H. T...	None...	Mech...
Simplex 1910	4450	53.0	Extra .	..	4	5¾	5¾	Pairs..	H'comb..	Cent 'fl	H. T...	None...	Mech...
Simplex 1910	5300	59.5	Extra .	..	4	6.1	5¾	Pairs..	H'comb..	Cent 'fl	H. T...	None...	Mech...
Speedwell 11-H	2500	40.0	F.d.Rr..	2	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Speedwell 11-C	2625	40.0	T ton..	4	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Speedwell 11-D	2650	40.0	Tour'g..	5	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Speedwell 11-K	2650	40.0	C coupl.	5	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Speedwell 11-G	2700	40.0	Torp'o..	4	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Speedwell 11-H Special	2700	40.0	S. rac'g	4	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Speedwell 11-D Special	2750	40.0	F.d.Tg..	5	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Speedwell 11-F	2800	40.0	Tour'g..	7	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Speedwell 11-F Special	2900	40.0	F.d.Tg..	7	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Speedwell 11-E	3850	40.0	Limous.	7	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..
Speedwell Cruiser	3500	40.0	Crusier.	4	4	5	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	Pump..

[1] Touring Clubman. [2] Or 6 or 7.

PIERCE-ARROW—Pierce-Arrow Motor Car Co., Buffalo, N. Y.
POPE-HARTFORD—The Pope Mfg. Co., Hartford, Conn.
PREMIER—Premier Motor Mfg. Co., Indianapolis, Ind.
PULLMAN—Pullman Motor Car Co., York, Pa.
RAINIER—Marquette Motor Co., Saginaw, Mich.
REGAL—Regal Motor Car Co., Detroit, Mich.

Don't overlook the importance of a good lighting system.
Don't decline to accept the windshield and top with the car.

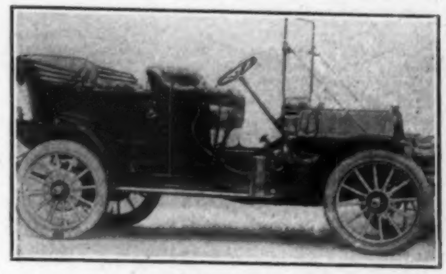
on the American Market for 1911

Clutch	Transmission: Type	Speeds	Location	Drive	Wheelbase	Tread	Frame	Bearings: Crankshaft	Trans-mis'n	Axle	Weight	Tires: Front	Rear
Cone	Sel.	4	Unit	Shaft	125	55	Chan. St.	Plain	Ball	B & R.	3380	36x4½	36x4½
Cone	Sel.	4	Unit	Shaft	134½	56	Chan. St.	Plain	Ball	B. & R.	4120	36x4½	37x5
Cone	Sel.	4	Unit	Shaft	140	56	Chan. St.	Plain	Ball	B. & R.	4500	37x5	38x5½
Cone	Sel.	4	Unit	Shaft	124	56	Chan. St.	Plain	Plain	Roller	.....	4½	4½
Cone	Sel.	4	Unit	Shaft	124	56	Chan. St.	Plain	Plain	Roller	.....	4½	4½
Cone	Sel.	4	Unit	Shaft	124	56	Chan. St	Plain	Plain	Roller	.....	4½	4½
Cone	Sel.	4	Unit	Shaft	124	56	Chan. St.	Plain	Plain	Roller	.....	4½	4½
Cone	Sel.	4	Unit	Shaft	124	56	Chan. St	Plain	Plain	Roller	.....	4½	5
Cone	Sel.	4	Unit	Shaft	124	56	Chan. St.	Plain	Plain	Roller	.....	4½	5
Cone	Sel.	4	Unit	Shaft	124	56	Chan. St.	Plain	Plain	Roller	.....	4½	5
Cone	Sel.	4	Unit	Shaft	134	56	Chan. St.	Plain	Plain	Roller	.....	38x4½	39x5
Cone	Sel.	4	Unit	Shaft	134	56	Chan. St.	Plain	Plain	Roller	.....	38x4½	39x5
Cone	Sel.	4	Unit	Shaft	134	56	Chan. St.	Plain	Plain	Roller	.....	38x4½	39x5
Cone	Sel.	4	Unit	Shaft	134	56	Chan. St.	Plain	Plain	Roller	.....	38x4½	39x5
Cone	Sel.	4	Unit	Shaft	134	56	Chan. St.	Plain	Plain	Roller	.....	38x4½	39x5
Cone	Sel.	4	Unit	Shaft	134	56	Chan. St.	Plain	Plain	Roller	.....	38x4½	39x5
M. Disc	Sel.	3	Motor	Shaft	126	56½	P. Steel	3 Plain	5 Ball	B. & R.	.....	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	126	56½	P. Steel	3 Plain	5 Ball	B. & R.	.....	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	126	56½	P. Steel	3 Plain	5 Ball	B. & R.	.....	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	126	56½	P. Steel	3 Plain	5 Ball	B. & R	.....	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	126	56½	P. Steel	3 Plain	5 Ball	B. & R.	.....	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	140	56½	P. Steel	4 Plain	5 Ball	B. & R.	.....	36x4½	36x5
M. Disc	Sel.	3	Motor	Shaft	140	56½	P. Steel	4 Plain	5 Ball	B. & R	.....	36x4½	36x5
M. Disc	Sel.	3	Motor	Shaft	140	56½	P. Steel	4 Plain	5 Ball	B. & R.	.....	36x4½	36x5
M. Disc	Sel.	3	Motor	Shaft	140	56½	P. Steel	4 Plain	5 Ball	B. & R.	.....	36x4½	36x5
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	3 Plain	Ball	Ball	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	3 Plain	Ball	Ball	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	3 Plain	Ball	Ball	.....	34x4	34x4
Cone	Sel.	4	Unit	Shaft	126	56	P. Steel	5 Plain	Ball	Ball	.....	36x4½	36x4½
Cone	Sel.	4	Unit	Shaft	126	56	P. Steel	5 Plain	Ball	Ball	.....	36x4½	36x4½
Cone	Sel.	3	Unit	Shaft	114	56	P. Steel	5 Plain	Ball	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	114	56	P. Steel	5 Plain	Ball	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	114	56	P. Steel	5 Plain	Ball	Roller	.....	34x4	34x4
M. Disc	Sel.	4	Motor	Shaft	119	56	P. Steel	Plain	Ball	Ball	3500	36x4½	36x4½
M. Disc	Sel.	4	Motor	Shaft	119	56	P. Steel	Plain	Ball	Ball	3500	36x4½	36x4½
M. Disc	Sel.	4	Motor	Shaft	119	56	P. Steel	Plain	Ball	Ball	3500	36x4½	36x4½
Cone	Sel.	3	Axle	Shaft	100	56	P. Steel	Plain	Roller	Roller	.....	32x3	32x3
Cone	Sel.	3	Axle	Shaft	110	56	P. Steel	Plain	Roller	Roller	.....	32x4	33x4
Cone	Sel.	3	Axle	Shaft	123	56	P. Steel	Plain	Roller	Roller	.....	34x4	34x4
M. Disc	Sel.	3	Unit	Shaft	108	[4]56	P. Steel	Plain	Ball	Roller	2350	34x3½	34x3½
M. Disc	Sel.	3	Unit	Shaft	108	[4]56	P. Steel	Plain	Ball	Roller	2500	34x3½	34x3½
M. Disc	Sel.	2	Axle	Shaft	98	[4]56	P. Steel	Plain	Ball	Roller	1650	32x3½	32x3½
Cone	Sel.	4	Unit	Shaft	126	56	N. Steel	Plain	Ball	Roller	3800	36x4½	36x5
Disc	Sel.	4	Unit	Shaft	115[3]	56	P. Steel	Plain	Ball	Ball	2500	34x4	34x4
Disc	Sel.	4	Unit	Shaft	115[3]	56	P. Steel	Plain	Ball	Ball	2500	34x4	34x4
Cone	Sel.	3	S. Frame	Shaft	125	56	P. Steel	3 Plain	Roller	Line	2700	36x4	36x4
Cone	Sel.	3	S. Frame	Shaft	125	56	P. Steel	3 Plain	Roller	Line	3000	36x4	36x4
Cone	Sel.	3	S. Frame	Shaft	125	56	P. Steel	3 Plain	Roller	Line	3100	36x4	36x4
Cone	Sel.	3	S. Frame	Shaft	122	56	P. Steel	3 Plain	Roller	Line	3000	36x4	36x4½
Cone	Sel.	3	S. Frame	Shaft	116	56	P. Steel	3 Plain	Roller	Line	2900	34x4	34x4
M. Disc	Sel.	4	Unit	2 Chain	124	56	P. Steel	P. & B.	Ball	Ball	.....	36x4	36x5
M. Disc	Sel.	4	Unit	2 Chain	129	56	P. Steel	P. & B.	Ball	Ball	.....	36x4	36x5
M. Disc	Sel.	4	Unit	2 Chain	124	56	P. Steel	P. & B.	Ball	Ball	.....	34x4	34x5
Cone	Sel.	3	Unit	Shaft	121	56	P. Steel	Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	121	56	P. Steel	Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	121	56	P. Steel	Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	121	56	P. Steel	Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	121	56	P. Steel	Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	121	56	P. Steel	Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	121	56	P. Steel	Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	121	56	P. Steel	Plain	Roller	Roller	.....	36x4½	36x4½
Cone	Sel.	3	Unit	Shaft	121	56	P. Steel	Plain	Roller	Roller	.....	36x4½	36x4½
Cone	Sel.	3	Unit	Shaft	121	56	P. Steel	Plain	Roller	Roller	.....	36x4½	36x4½
Cone	Sel.	3	Unit	Shaft	132	56	P. Steel	Plain	Roller	Roller	.....	36x4½	36x4½

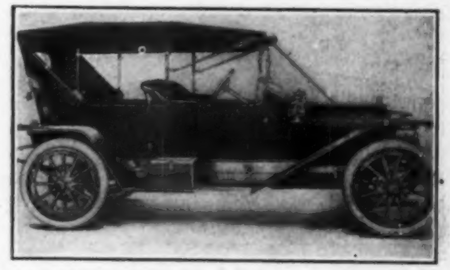
[3] Cr 3. [4] Or 60 inches.

REO—Reo Motor Car Co., Lansing, Mich.
ROYAL TOURIST—Royal Tourist Car Co., Cleveland, O.
S. G. V.—Acme Motor Car Co., Reading, Pa.
SIMPLEX—Simplex Automobile Co., 614 East Eighty-third Street, New York.
SPEEDWELL—Speedwell Motor Car Co., Dayton, O.
SELDEN—Selden Motor Vehicle Co., Rochester, N. Y.

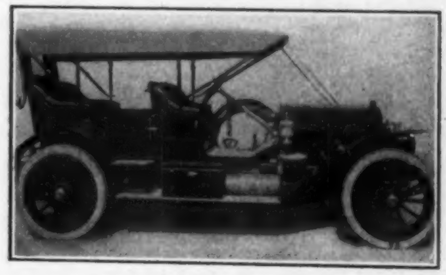
Don't omit a good signal system with the equipment.



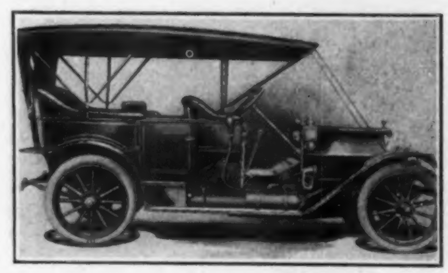
Reo Model "R" touring car



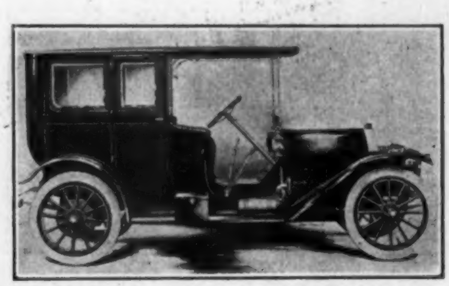
Selden Model "44" flush-sided touring



Simplex 50 H. P. toy tonneau

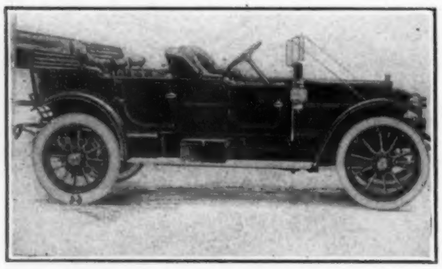


Speedwell Model 11-F touring car

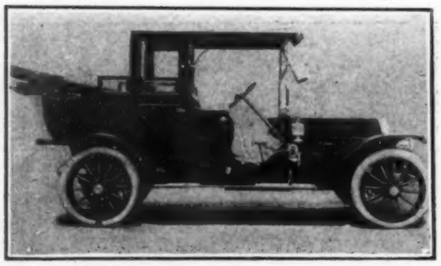


National "40" 7-passenger limousine

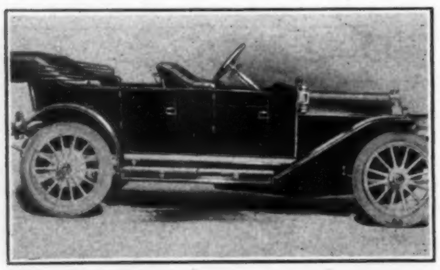
Details of Passenger Automobiles



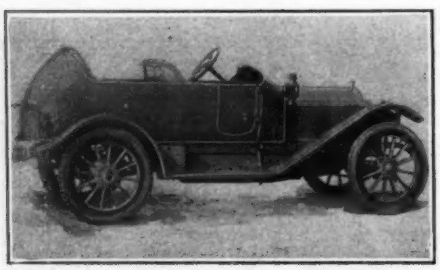
Stearns 30-60 H. P. vestibule touring car



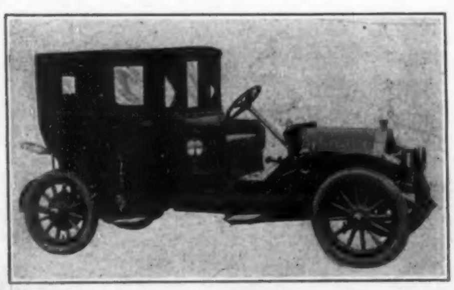
Stevens-Duryea Model AA 35 H. P. landaulette.



Stoddard Dayton "40" 11-A fore-door touring



Studebaker-Garford "40" torpedo



Thomas "Flyer," 4-28 town car brougham

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY Type	BODY Seats	MOTOR Cyl.	MOTOR Bore Inches	MOTOR Stroke Inches	MOTOR Cyl. Cast	COOLING Radiator	COOLING Pump	IGNITION Magneto	IGNITION Battery	Lubrication
Stearns 15-30	$3200	32.4	Tour'g..	5	4	4½	4½	Block.	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stearns 15-30	3200	32.4	T.ton...	4	4	4½	4½	Block.	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stearns 15-30	4600	32.4	Land't..	7	4	4½	4½	Block.	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stearns 15-30	4600	32.4	Limous.	7	4	4½	4½	Block.	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stearns 30-60	4600	46.0	Tour'g..	7	4	5⅜	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stearns 30-60	4600	46.0	T. ton..	4	4	5⅜	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stearns 30-60	5850	46.0	Land't..	7	4	5⅜	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stearns 30-60	5750	46.0	Limous.	7	4	5⅜	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Stoarge	Pump..
Stearns 30-60	4600	46.0	Tour'g..	7	4	5⅜	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stearns 30-60	4600	46.0	T. ton..	4	4	5⅜	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stearns 30-60	5850	46.0	Land't..	7	4	5⅜	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stearns 30-60	5750	46.0	Limous.	7	4	5⅜	5½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	Pump..
Stevens-Duryea "AA"	3500	43.8	F.d.Tg..	5	6	4¼	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	F. feed.
Stevens-Duryea "AA"	3500	43.8	Tour'g..	5	6	4¼	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	F. feed.
Stevens-Duryea "AA"	3500	43.8	Tg.Rr..	4	6	4¼	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	F' feed.
Stevens-Duryea "AA"	3600	43.8	Torp'o..	5	6	4¼	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	F. feed.
Stevens-Duryea "AA"	4600	43.8	Limous.	7	6	4¼	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	F. feed.
Stevens-Duryea "AA"	4800	43.8	Land't..	7	6	4¼	4¾	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	F. feed.
Stevens-Duryea "Y"	4000	54.1	Tour'g..	7	6	4¾	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	F. feed.
Stevens-Duryea "Y"	4150	54.1	F.d.Tg.	7	6	4¾	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	F. feed.
Stevens-Duryea "Y"	5150	54.1	Limous.	7	6	4¾	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Storage	F. feed.
Stevens-Duryea "X"	2850	24.0	Tour'g..	5	4	4⅛	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	F. feed.
Stevens-Duryea "X"	2850	24.0	Tg.Rr..	4	4	4⅛	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	F. feed.
Stevens-Duryea "X"	3000	24.0	F.d.Tg..	5	4	4⅛	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	F. feed.
Stevens-Duryea "X"	4000	24.0	Limous.	7	4	4⅛	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	F. feed.
Stoddard-Dayton—													
"50" 11-F	4000	40.0	Limous.	7	4	5	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"50" 11-F	4200	40.0	F.d.Li..	7	4	5	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"50" 11-F	4000	40.0	Land't.	7	4	5	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"50" 11-F	3000	40.0	Tour'g.	5	4	5	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"50" 11-K	3000	40.0	Torp'o.	5	4	5	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"50" 11-K	2950	40.0	S. T'do.	2	4	5	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"50" 11-K	2900	40.0	Tg. Rr..	5	4	5	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"50" 11-K	2900	40.0	B. ton.	4	4	5	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"50" 11-K	2850	40.0	R'ster..	2	4	5	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"50" 11-S	2800	40.0	S'ster...	2	4	5	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"40" 11-A	2300	36.1	Tour'g..	5	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"40" 11-A	2400	36.1	F.d.Tg..	5	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"40" 11-C	2300	36.1	Tg.Rr..	5	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"40" 11-C	2300	36.1	B.ton...	4	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"40" 11-C	2350	36.1	Torp'o..	4	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"40" 11-C	2275	36.1	S.ton...	2	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"40" 11-C	2200	36.1	R'ster..	2	4	4¾	5	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"30" 11-T	2700	27.2	Limous.	5	4	4⅛	5¼	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"30" 11-T	2700	27.2	Land't..	5	4	4⅛	5¼	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"30" 11-T	2350	27.2	Coupe..	3	4	4⅛	5¼	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"30" 11-B	1700	27.2	Tour'g..	5	4	4⅛	5¼	Pairs..	Tubular.	Cent 'fl	H. T....	Storage	Pump..
"30" 11-B	1750	27.2	F.d.Tg..	5	4	4⅛	5¼	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"30" 11-H	1550	27.2	R'ster..	2	4	4⅛	5¼	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"20" 11-R-1	1175	25.6	R'ster..	2	4	4	4½	Block.	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"20" 11-L-4	1250	25.6	Tg.Rr..	4	4	4	4½	Block.	Tubular.	Cent 'fl	H. T...	Storage	Pump..
"20" 11-M	1275	25.6	Tour'g..	5	4	4	4½	Block.	Tubular.	Cent 'fl	H. T...	Storage	Pump..
Studebaker-Garf'd G8	4750	36.1	Limous.	7	4	4¾	5½	Pairs..	H'comb..	Cent 'fl	L. T....	Storage	F. feed..
Studebaker-Garf'd G8	3500	36.1	Tour'g..	7	4	4¾	5½	Pairs..	H'comb..	Cent 'fl	L. T....	Storage	F. feed..
Studebaker-Garf'd G10	3500	28.9	T.Tour.	5	4	4¼	5½	Pairs..	H'comb..	Cent 'fl	L. T....	Storage	F. feed.
Studebaker-Garf'd A	2250	25.6	Chassis.	..	4	4	3¾	Pairs..	Tubular.	Cent 'fl	L. T....	Storage	Splash..
Studebaker-Garf'd B	2850	36.1	Chassis.	..	4	4¾	5½	Pairs..	Tubular.	Cent 'fl	L. T....	Storage	F. feed.
Studebaker-Garf'd C	3250	36.1	Chassis.	..	4	4¾	5½	Pairs..	Tubular.	Cent 'fl	L. T....	Storage	F. feed.
Thomas K	6000	72.6	Tour'g..	7	6	5½	5½	Single.	H'comb..	Gear..	H. T...	Dry....	Mech...
Thomas K	6000	72.6	Fly'b't.	4	6	5½	5½	Single.	H'comb..	Gear..	H. T...	Dry....	Mech...
Thomas K	6000	72.6	T'bout..	[1]	6	5½	5½	Single.	H'comb..	Gear..	H. T...	Dry....	Mech....
Thomas K	3500	72.6	Limous.	7	6	5½	5½	Single.	H'comb..	Gear..	H T...	Dry....	Mech...
Thomas K	7600	72.6	Land't..	7	6	5½	5½	Single.	H'comb..	Gear..	H. T...	Dry....	Mech...
Thomas M	3750	43.8	Tour'g..	5	6	4¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Mech...
Thomas M	3900	43.8	F.dTg..	5	6	4¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Mech...
Thomas M	3850	43.8	Tour'g..	7	6	4¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Mech...
Thomas M	4000	43.8	F.d.Tg..	7	6	4¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Mech...
Thomas M	3750	43.8	F'bout..	4	6	4¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Mech...
Thomas M	3900	43.8	F.d.F.t.	4	6	4¼	5½	Pairs..	H.comb..	Cent 'fl	H. T...	Dry....	Mech...
Thomas M	3750	43.8	Tour'g..	4	6	4¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Mech...
Thomas M	5000	43.8	Limous.	7	6	4¼	5½	Pairs..	H'comb	Cent 'fl	H. T...	Dry....	Mech...
Thomas M	5100	43.8	Land't..	7	6	4¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Mech...
Thomas R	4000	28.0	Brougm	6	4	4¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Mech...
Thomas R	4100	28.0	Limous.	6	4	4¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Mech...
Thomas R	4250	28.0	Land't..	6	4	4¼	5½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Mech...

[1] 2, 3 or 4.

STEARNS—F. B. Stearns Co., Cleveland, O.
STEVENS-DURYEA—Stevens-Duryea Co., Chicopee Falls, Mass.
STODDARD-DAYTON—Dayton Motor Car Co., Dayton, O.

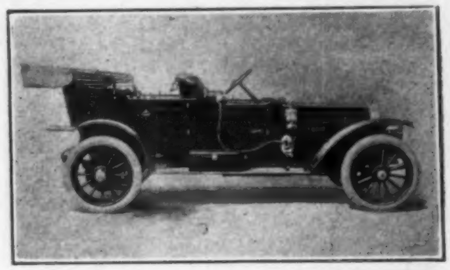
Don't disregard the instructions of the demonstrator and the fact that you should become acquainted with the oiling system of the car that you purchase.

on the American Market for 1911

Clutch	Transmission Type	Speeds	Location	Drive	Wheelbase	Tread	Frame	Bearings Crankshaft	Bearings Trans-mis'n	Bearings Axle	Weight	Tires Front	Tires Rear
M. Disc	Sel.	3	Axle	Shaft	116	56½	P. Steel	Ball	Ball	Roller	3000	34x4	34x4
M. Disc	Sel.	3	Axle	Shaft	116	56½	P. Steel	Ball	Ball	Roller	2800	34x4	34x4
M. Disc	Sel.	3	Axle	Shaft	116	56½	P. Steel	Ball	Ball	Roller	3500	34x4	34x4
M. Disc	Sel.	3	Axle	Shaft	116	56½	P. Steel	Ball	Ball	Roller	3500	34x4	34x4
M. Disc	Sel.	4	Unit	Chain	124	56½	P. Steel	Ball	Ball	Roller	3800	36x4	36x5
M. Disc	Sel.	4	Unit	Chain	121	56½	P. Steel	Ball	Ball	Roller	3600	36x4	36x4½
M. Disc	Sel.	4	Unit	Chain	124	56½	P. Steel	Ball	Ball	Roller	4300	36x4	36x5
M. Disc	Sel.	4	Unit	Chain	124	56½	P. Steel	Ball	Ball	Roller	4300	36x4	36x5
M. Disc	Sel.	4	Unit	Shaft	124	56½	P. Steel	Ball	Ball	Roller	3800	36x4	36x5
M. Disc	Sel.	4	Unit	Shaft	121-	56½	P. Steel	Ball	Ball	Roller	3600	36x4	36x4½
M. Disc	Sel.	4	Unit	Shaft	124	56½	P. Steel	Ball	Ball	Roller	4300	36x4	36x5
M. Disc	Sel.	4	Unit	Shaft	124	56½	P. Steel	Ball	Ball	Roller	4300	36x4	36x5
M. Disc	Sel.	3	Motor	Shaft	128	56	Chr.-N.	Plain	Ball	Ball	3350	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	128	56	Chr.-N.	Plain	Ball	Ball	3300	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	128	56	Chr.-N.	Plain	Ball	Ball	3250	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	128	56	Chr.-N.	Plain	Ball	Ball	3350	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	128	56	Chr.-N.	Plain	Ball	Ball	3600	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	128	56	Chr.-N.	Plain	Ball	Ball	3550	36x4½	36x4½
M. Disc	Sel.	3	Motor	Shaft	142	56	Chr.-N.	Plain	Ball	Ball	3450	36x4	36x5
M. Disc	Sel.	3	Motor	Shaft	142	56	Chr.-N.	Plain	Ball	Ball	3500	36x4	36x5
M. Disc	Sel.	3	Motor	Shaft	142	56	Chr.-N.	Plain	Ball	Ball	3800	36x4	36x5
M. Disc	Sel.	3	Motor	Shaft	124	56	Chr.-N.	Plain	Ball	Ball	2700	34x4	34x4
M. Disc	Sel.	3	Motor	Shaft	124	56	Chr.-N.	Plain	Ball	Ball	2700	34x4	34x4
M. Disc	Sel.	3	Motor	Shaft	124	56	Chr.-N.	Plain	Ball	Ball	2775	34x4	34x4
M. Disc	Sel.	3	Motor	Shaft	124	56	Chr.-N.	Plain	Ball	Ball	3190	34x4	34x4
Cone	Sel.	3	Unit	Shaft	130	56	P. Steel	3 Plain	Roller	Roller	.....	36x5	36x5
Cone	Sel.	3	Unit	Shaft	130	56	P. Steel	3 Plain	Roller	Roller	.....	36x5	36x5
Cone	Sel.	3	Unit	Shaft	130	56	P. Steel	3 Plain	Roller	Roller	.....	36x5	36x5
Cone	Sel.	3	Unit	Shaft	130	56	P. Steel	3 Plain	Roller	Roller	.....	36x4½	36x4½
Cone	Sel.	3	Unit	Shaft	130	56	P. Steel	3 Plain	Roller	Roller	.....	36x4½	36x4½
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4½	36x4½
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4½	36x4½
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4½	36x4½
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4½	36x4½
Cone	Sel.	3	Unit	Shaft	106	56	P. Steel	3 Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	3 Plain	Roller	Roller	.....	36x4	36x4
Cone	Sel.	3	Unit	Shaft	114	56	P. Steel	3 Plain	Roller	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	114	56	P. Steel	3 Plain	Roller	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	114	56	P. Steel	3 Plain	Roller	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	114	56	P. Steel	3 Plain	Roller	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	114	56	P. Steel	3 Plain	Roller	Roller	.....	34x4	34x4
Cone	Sel.	3	Unit	Shaft	114	56	P. Steel	3 Plain	Roller	Roller	.....	34x3½	34x3½
Cone	Sel.	3	Unit	Shaft	112	56	P. Steel	3 Plain	Roller	Roller	.....	32x3½	32x3½
Cone	Sel.	3	Unit	Shaft	112	56	P. Steel	3 Plain	Roller	Roller	.....	32x3½	32x3½
Cone	Sel.	3	Unit	Shaft	112	56	P. Steel	3 Plain	Roller	Roller	.....	32x3½	32x3½
Cone	Sel.	4	Unit	Shaft	118	56	P. Steel	Plain	Ball	Ball	3600	36x4	36x4½
Cone	Sel.	4	Unit	Shaft	118	56	P. Steel	Plain	Ball	Ball	3600	36x4	36x4½
Cone	Sel.	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Ball	3150	36x4	36x4
None	Frict'n	4	Unit	Shaft	125	56	P. Steel	Plain	Roller	Roller	3600	34x3	34x3½
None	Frict'n	4	Unit	Shaft	140	56	P. Steel	Plain	Roller	Roller	4600	34x3½	36x3
None	Frict'n	4	Unit	Shaft	140	56	P. Steel	Plain	Roller	Roller	4900	34x4	36x3½
3 Disc	Sel.	4	Unit	Chain	140	56	P. Steel	Plain	B.&R.	Ball	4500	38x4½	38x5½
3 Disc	Sel.	4	Unit	Chain	140	56	P. Steel	Plain	B.&R.	Ball	4340	38x4½	38x4½
3 Disc	Sel.	4	Unit	Chain	140	56	P. Steel	Plain	B.&R.	Ball	4250	38x4½	38x4½
3 Disc	Sel.	4	Unit	Chain	140	56	P. Steel	Plain	B.&R.	Ball	4800	38x4½	38x5½
3 Disc	Sel.	4	Unit	Chain	140	56	P. Steel	Plain	B.&R.	Ball	4800	38x4½	38x5½
3 Disc	Sel.	3	Unit	Shaft	125	56	P. Steel	Plain	Ball	Roller	3775	36x4½	36x4½
3 Disc	Sel.	3	Unit	Shaft	125	56	P. Steel	Plain	Ball	Roller	3800	36x4½	36x4½
3 Disc	Sel.	3	Unit	Shaft	125	56	P. Steel	Plain	Ball	Roller	3800	36x4½	37x5
3 Disc	Sel.	3	Unit	Shaft	125	56	P. Steel	Plain	Ball	Roller	3800	36x4½	37x5
3 Disc	Sel.	3	Unit	Shaft	125	56	P. Steel	Plain	Ball	Roller	3660	36x4½	36x4½
3 Disc	Sel.	3	Unit	Shaft	125	56	P. Steel	Plain	Ball	Roller	3685	36x4½	36x4½
3 Disc	Sel.	3	Unit	Shaft	125	56	P. Steel	Plain	Ball	Roller	3650	36x4½	36x4½
3 Disc	Sel.	3	Unit	Shaft	125	56	P. Steel	Plain	Ball	Roller	4150	36x4½	37x5
3 Disc	Sel.	3	Unit	Shaft	125	56	P. Steel	Plain	Ball	Roller	4175	36x4½	37x5
3 Disc	Sel.	3	Unit	Shaft	123	56	P. Steel	Plain	Ball	Roller	3650	34x4½	34x4½
3 Disc	Sel.	3	Unit	Shaft	123	56	P. Steel	Plain	Ball	Roller	3680	34x4½	34x4½
3 Disc	Sel.	3	Unit	Shaft	123	56	P. Steel	Plain	Ball	Roller	3680	34x4½	34x4½

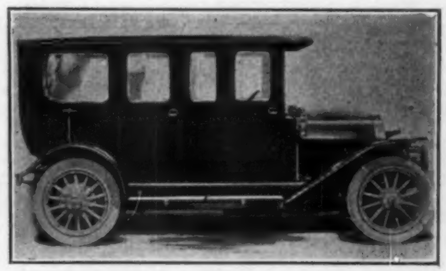
STUDEBAKER—Studebaker Automobile Co., Cleveland, O.
THOMAS—E. R. Thomas Motor Co., Buffalo, N. Y.

Don't tinker with the mechanisms of the car, nor fail to provide a sufficient quantity of good lubricating oil for each of the bearings.



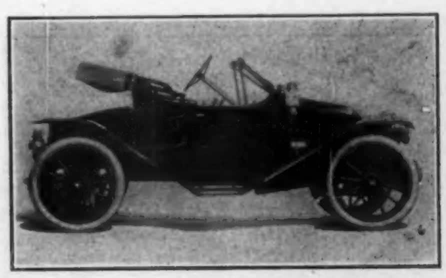
Stevens-Duryea Model AA fore-door standard

Peerless limousine with central control



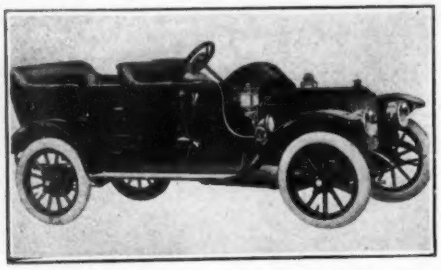
Stoddard-Dayton 50 11F limousine

Pierce-Arrow 48 H. P. protected touring car



Franklin Model G torpedo phaeton

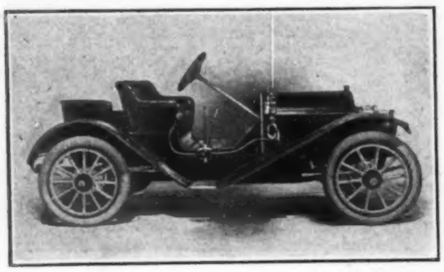
Details of Passenger Automobiles



White 20-30 H. P. 5-passenger torpedo

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY Type	Seats	MOTOR Cyl.	Bore inches	Stroke inches	Cyl. Cast	COOLING Radiator	Pump	IGNITION Magneto	Battery	Lubrication
White G-A	$2000	22.5	Tour'g..	5	4	$3\frac{3}{4}$	$5\frac{1}{4}$	Block.	H'comb..	Cent'fl	H. T...	None...	Pump..
White G-B	3000	22.5	Tour'g..	5	4	$3\frac{3}{4}$	$5\frac{1}{4}$	Block.	H'comb..	Cent'fl	H. T...	None...	Pump..
White G-A	2000	22.5	Tour'g..	..	4	$3\frac{3}{4}$	$5\frac{1}{4}$	Block.	H'comb..	Cent'fl	H. T...	None...	Pump..
White G-B	2500	22.5	Tour'g..	5	4	$3\frac{3}{4}$	$5\frac{1}{4}$	Block.	H'comb..	Cent'fl	H. T...	None...	Pump..
White G-E	3200	22.5	Torp'o..	7	4	$3\frac{3}{4}$	$5\frac{1}{4}$	Block.	H'comb..	Cent'fl	H. T...	None...	Pump..
White G-B	3600	22.5	Limous.	5	4	$3\frac{3}{4}$	$5\frac{1}{4}$	Block.	H'comb..	Cent'fl	H. T...	None...	Pump..
White G-B	3800	22.5	Land't..	..	4	$3\frac{3}{4}$	$5\frac{1}{4}$	Block.	H'comb..	Cent'fl	H. T...	None...	Pump..
Winton "Six"	3000	48.6	Tg.T.R.	4	6	$4\frac{1}{2}$	5	Pairs..	Tubular.	Cent'fl	H. T...	......	Pump..
Winton "Six"	3250	48.6	Torp'o..	5	6	$4\frac{1}{2}$	5	Pairs..	Tubular.	Cent'fl	H. T...	......	Pump..
Winton "Six"	4250	48.6	Limous.	7	6	$4\frac{1}{2}$	5	Pairs..	Tubular.	Cent'fl	H. T...	......	Pump..
Winton "Six"	4500	48.6	Land't..	7	6	$4\frac{1}{2}$	5	Pairs..	Tubular.	Cent'fl	H. T...	......	Pump..
Winton "Six"	2750	48.6	Extra..	..	6	$4\frac{1}{2}$	5	Pairs..	Tubular.	Cent'fl	H. T...	......	Pump..

WHITE—White Co., Cleveland, O.

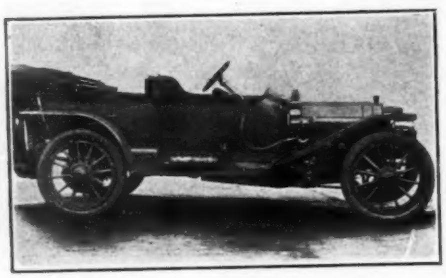


Hudson "33" two-seater with rumble

Review of the Palace Show

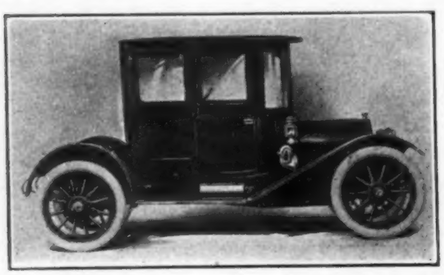
On Following Pages Will Be Found Details and Illustrations of the Cars Exhibited

NEW YEARS' EVE witnessed the opening of the automobile show at the Grand Central Palace in New York City under favorable auspices, with the weather poor and the attendance large. Much interest was centered in the aeronautical exhibition, and the attendance was increased, due to the presence of a fine display of aeroplanes, some of which are famous for the work they have already done in a relatively new field, while others are representative of the progress that is being made, with just a tinge of speculation in their composition, which impinges a certain piquancy on the plane of thought. Besides the excellence of the aeronautical display there was a considerable gathering of accessory makers whose products whetted the interest of the spectators, but the real *piece de resistance* was presented in the form of the display of automobiles by 41 makers representing 170 models of cars.



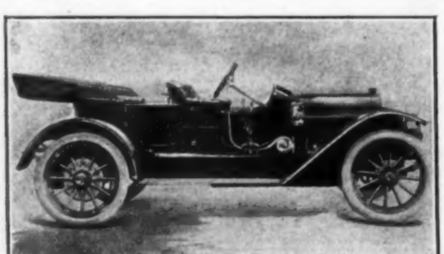
Locomobile torpedo aluminum body

In order to maintain a certain uniformity of presentation of all the automobiles of the year, the cars as they were shown at the Palace are here given in a tabulation which is designed on the same basis as that for the automobiles which will be on exhibition at the Garden when the A. L. A. M. show is opened there. An explanation of this tabulation is presented as a prelude to the A. L. A. M. table, and since they are both alike this explanation will serve throughout.



Chalmers "30" coupé

The freight automobiles which are on exhibition at the Palace are excluded from the tabulation, it being the intention to publish a complete file of all American-made freight automobiles in an early issue of THE AUTOMOBILE, so that merchants will have at their disposal a complete set of data covering the whole freight field. The aeronautical display at the Palace, while it is very interesting, can scarcely be looked upon as a desirable acquisition in connection with an automobile show, due to its disconcerting influence, and the fact that interested spectators, instead of confining themselves to the examination of the cars, are prone to wander off among a maze of aeroplanes and forget the object of their mission.



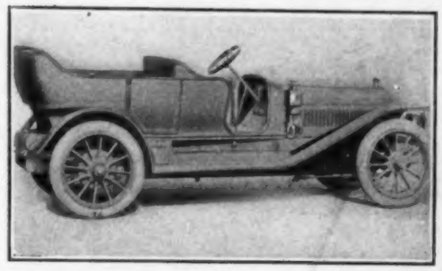
Columbia 4-passenger vestibule roadster

on the American Market for 1911

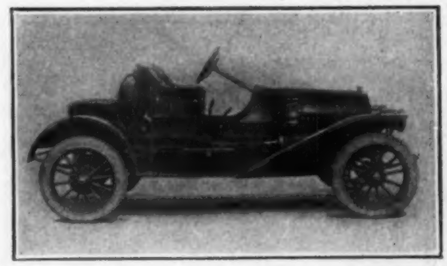
Clutch	TRANSMISSION Type	Speeds	Location	Drive	Wheelbase	Tread	Frame	BEARINGS Crank-shaft	Trans-mis'n	Axle	Weight	TIRES Front	Rear
Cone.....	Sel....	4	Unit....	Shaft....	110	56	P. Steel..	2 Ball..	Ball...	Ball....	.....	32x4	32x4
Cone.....	Sel....	4	Unit....	Shaft....	120	56	P. Steel.	2 Ball..	Ball...	Ball....	.....	36x4	36x4½
Cone.....	Sel....	4	Unit....	Shaft....	110	56	P. Steel.	2 Ball..	Ball...	Ball....	.....	32x4	32x4
Cone.....	Sel....	4	Unit....	Shaft....	120	56	P. Steel.	2 Ball..	Ball...	Ball....	.....	34x4	34x4
Cone.....	Sel....	4	Unit....	Shaft....	120	56	P. Steel..	2 Ball..	Ball...	Ball....	.....	34x4	34x4
Cone.....	Sel....	4	Unit....	Shaft....	120	56	P. Steel..	2 Ball..	Ball...	Ball....	.....	34x4	34x4
Cone.....	Sel....	4	Unit....	Shaft....	120	56	P. Steel..	2 Ball..	Ball...	Ball....	.....	34x4	34x4
M. Disc...	Sel....	4	Unit....	Shaft....	130	[1]56½	P. Steel.	4 Plain.	Ball...	Roller..	.....	36x4	36x4½
M. Disc...	Sel....	4	Unit....	Shaft....	130-	[1]56½	P. Steel.	4 Plain.	Ball...	Roller..	.....	36x4	36x4½
M. Disc...	Sel....	4	Unit....	Shaft....	130	[1]56½	P. Steel.	4 Plain.	Ball...	Roller..	.....	36x4	36x4½
M. Disc...	Sel....	4	Unit....	Shaft....	130	[1]56½	P. Steel..	4 Plain.	Ball...	Roller..	.....	36x4	36x4½
M. Disc...	Sel....	4	Unit....	Shaft....	130	[1]56½	P. Steel..	4 Plain.	Ball...	Roller..	.....	34x4	36x4½

[1] Or 60 inches

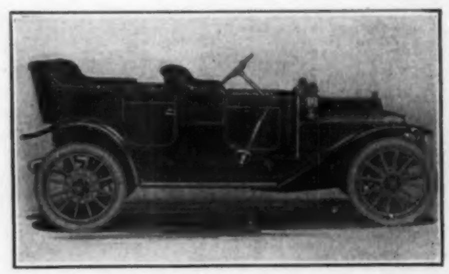
WINTON—Winton Motor Carriage Co., Cleveland, O.



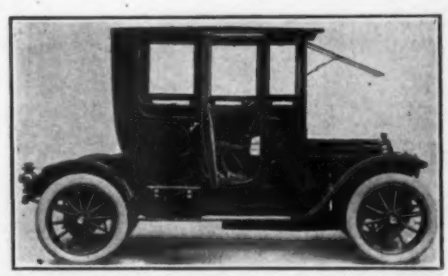
Winton 6-cylinder touring car



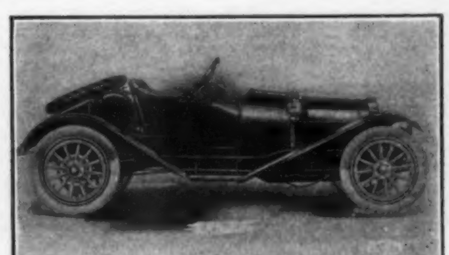
Jackson Model 25 roadster



White 20-30 H. P. 6-passenger coupé



White 20-30 H. P. 4-passenger coupé



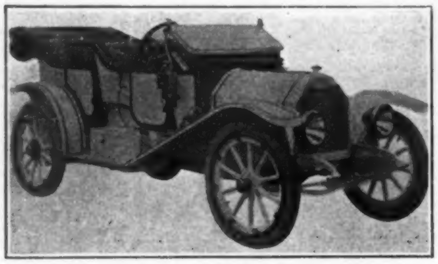
Overland 2-seated torpedo

As a matter of fact the brave showing made by the automobiles at the Palace is in the face of a series of circumstances which are largely due to the absence of a maker's organization. The idea of destroying the value of the automobile display by interjecting a novelty could not be averted, due to the fact that the show is being conducted by promoters rather than by an organization of automobile makers. It may be good management, from the point of view of the promoters, but as an automobile project the aeroplanes, in combination with bad weather, are having a marked influence which is not altogether to the good of the automobile industry.

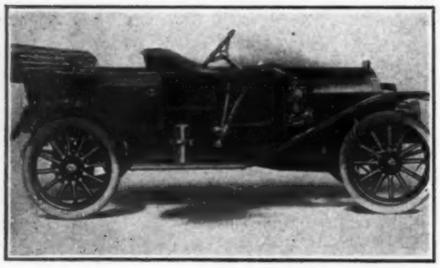
The experience that is being gathered by the makers of automobiles who are exhibiting at the Palace should be worth something to them, and the prospects are in favor of a better organization for the conduct of the show a year hence; moreover, the elimination of the promoter idea is in keeping with show traditions in this country, and those who have any ground for contesting the point against the promoter idea will do well to investigate the English show situation, it being the case that the Olympia is controlled by promoters, and the makers of automobiles of Great Britain pay the score. At all events, they provide the funds necessary to support the promoters, and in the long run the patrons of the automobile industry loosen their purse strings to make up for the deficit.

Those who have in mind the purchase of a good automobile should remember that the time is not ripe to invest in flying machines for utility purposes, and they should also take into account the fact that they now have an opportunity to leisurely examine the products of the makers who have brought their automobiles to the Palace Show, and that it will be twelve months ere this opportunity will be afforded again. The great question is to go to the show with the specific idea of making a critical examination on a comparative basis, considering the extent of funds available for the purchase of an automobile, and to avoid having the mind distracted by outside and immaterial considerations. The general showing that is being made by the automobiles exhibited is receiving favorable mention by all who are competent to judge, and this is in the face of the fact that preparation began too late to afford the best result. The presence of freight automobiles has added a considerable measure of interest, although the character of the audience takes on a distinct tone in favor of those who use passenger automobiles.

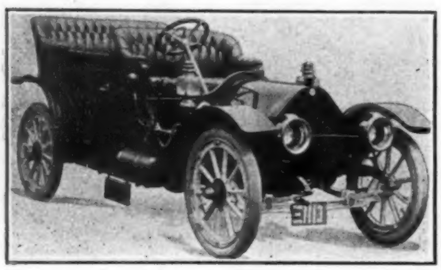
Details of Passenger Automobiles



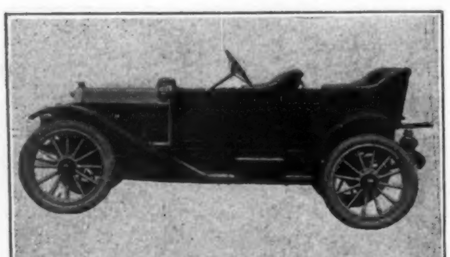
Abbott-Detroit fore-door touring car



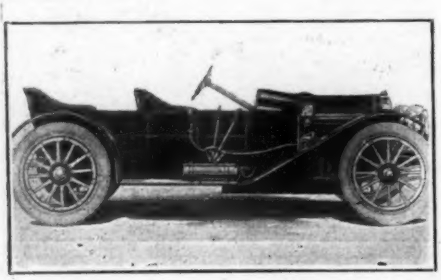
Alpena-Flyer of the fore-door type



Bergdoll type of touring car



Warren-Detroit "30" fore-door touring car



Cole "30" fore-door touring car

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY Type	BODY Seats	MOTOR Cyl.	MOTOR Bore Inches	MOTOR Stroke Inches	MOTOR Cyl. Cast	COOLING Radi-ator	COOLING Pump	IGNITION Mag-neto	IGNITION Battery	Lubrication
Abbott-Detroit "B"	$1500	25.6	Tour'g..	5	4	4	4½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Abbott-Detroit "B"	1500	25.6	R'bout.	3	4	4	4½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Abbott-Detroit "B"	1650	25.6	F.d.D.T	4	4	4	4½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Abbott-Detroit "B"	2200	25.6	Coupe..	4	4	4	4½	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Abbott-Detroit	1500	25.6	Tour'g..	5	4	4	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Abbott-Detroit	1650	25.6	D. ton..	4	4	4	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Abbott-Detroit	1500	25.6	R'ster..	2	4	4	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Abbott-Detroit	2350	25.6	Coupe..	3	4	4	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Alpena Flyer A	1450	25.6	Touring	5	4	4	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	F.f.-G..
Alpena Flyer B	1450	25.6	F.d.Tg..	4	4	4	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	F.f.-G..
Alpena Flyer C	1600	25.6	F.d.Tg..	5	4	4	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	F.f.-G..
Alpena Flyer D	1450	25.6	R'ster..	2	4	4	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	F.f.-G..
Arbenz	1700	27.2	F.d.Tg..	5	4	4⅛	5¼	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Arbenz	1700	27.2	Torp'o..	4	4	4⅛	5¼	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Arbenz	1700	27.2	R'ster..	3	4	4⅛	5¼	Pairs..	H'comb..	Cent 'fl	H. T...	Dry....	Splash..
Atterbury A-16	1000	16.2	Option'l	..	2	4½	4	Opp'd.	Tubular.	Syph'n	None...	Dry....	F. feed.
Atterbury K-20	1600	22.5	Option'l	..	4	3¾	4¼	Single.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Atterbury L-30	2500	28.9	Option'l	..	4	4¼	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Atterbury N-40	3000	36.1	Option'l	..	4	4¾	5½	Single.	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Atterbury M-50	3500	38.0	Option'l	..	4	4⅞	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Atterbury O-70	4500	48.4	Option'l	..	4	5½	6	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Atterbury G-30	2750	32.4	St. S'ng	4	4	4½	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Atterbury H-50	3750	38.0	St. S'ng	5	4	4⅞	5½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Pump..
Auburn Y	1700	32.4	Tour'g..	5	4	4½	5	Single.	Tubular.	Gear..	H. T...	Dry....	Sf.-con.
Auburn N	1750	32.4	Torpe'o	5	4	4½	5	Single.	Tubular.	Gear..	H. T...	Dry....	Sf. con.
Auburn T	1700	32.4	D. ton..	4	4	4½	5	Single	Tubular.	Gear..	H. T...	Dry....	St. con.
Auburn M	1700	32.4	R'ster..	2	4	4½	5	Single	Tubular.	Gear..	H. T...	Dry....	Sf. con.
Auburn L	1400	25.6	V.- cl. C	5	4	4	4	Single.	Tubular.	Gear..	H. T...	Dry....	Sf. con.
Auburn G	1000	22.0	Tg. Rr..	5	2	3½	5	Single.	Tubular.	Gear..	H. T...	Storage	Mech...
Auburn K	1000	22.0	R'ster..	3	2	3½	5	Single.	Tubular.	Gear..	H. T...	Storage	Mech...
Babcock F	3000	32.4	Tour'g..	5	4	4½	5	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	F. feed..
Babcock D	2500	27.0	Tour'g..	..	4	4⅛	5¼	Pairs..	H'comb..	Cent 'fl	H. T...	Storage	F. feed.
Bergdoll "30"	1500	25.6	Tour'g..	5	4	4	4½	Block.	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Bergdoll "30"	1500	25.6	R'ster..	3	4	4	4½	Block.	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Bergdoll "30"	1600	25.6	T. ton..	4	4	4	4½	Block.	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Bergdoll "30"	1600	25.6	F.d.Tg..	5	4	4	4½	Block.	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Bergdoll "30"	2000	25.6	Taxi...	4	4	4	4½	Block.	Cellular..	Cent 'fl	H. T...	Dry,...	Splash..
Bergdoll "30"	2000	25.6	Coupe..	2	4	4	4½	Block.	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Bergdoll "30"	2500	25.6	Col. cp.	3	4	4	4½	Block.	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Bergdoll "30"	2500	25.6	Limous.	5	4	4	4½	Block.	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Bergdoll "30"	2600	25.6	Land't..	5	4	4	4½	Block.	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Clark A	1250	25.6	Tour'g..	5	4	4	4	Single	Tubular.	Gear..	H. T...	Dry....	Sf. con.
Clark A	1250	25.6	Tor. Rr	2	4	4	4	Single.	Tubular.	Gear..	H. T...	Dry....	Sf. con.
Clark C	1600	32.4	Tour'g..	5	4	4½	5	Single.	Tubular.	Gear..	H. T...	Dry....	Sf con.
Cole 30-M	1650	36.0	T. ton..	4	4	4¼	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Cole 30-A	1650	36.0	Tour'g..	4	4	4¼	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Cole 30-O	1600	36.0	Tour'g..	4	4	4¼	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Cole 30-L	1600	36.0	R'ster..	2	4	4¼	4½	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Splash..
Correja A	1450	28.9	Torp'o..	2	4	4¼	5	Pairs..	H'comb..	Cent 'fl	H. T...	None...	Pump..
Crawford 11-30	1375	28.9	Tour'g..	5	4	4¼	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Crawford 11-35	1650	32.4	Tour'g..	5	4	4½	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Cunningham H	3500	36.1	Tour'g..	7	4	4¾	5¼	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Splash..
Cunningham H	3500	36.1	Cl. cpld	7	4	4¾	5¼	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Splash..
Cunningham H	3500	36.1	R'ster...	7	4	4¾	5¼	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Splash..
Cunningham H	4500	36.1	Limous.	7	4	4¾	5¼	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Splash..
Cunningham H	4500	36.1	Land't..	7	4	4¾	5¼	Pairs..	Tubular.	Cent 'fl	H. T...	Storage	Splash..
Cutting 30	1100	22.5	R'ster..	2	4	3¾	5	Block.	Tubular.	None..	H. T...	....	Splash..
Cutting 40	1350	28.9	Tour'g..	5	4	4¼	4½	Pairs..	Tubular.	None..	H. T...	....	Splash..
Cutting 50	1650	28.9	Tour'g .	5	4	4¼	5	Single.	Tubular.	None..	H. T...	....	Splash..
Cutting 60	2250	36.1	Tour'g..	5	4	4¾	5½	Pairs..	Tubular.	None..	H. T...	....	Splash..
De Tamble G	1000	36.0	R'ster..	2	4	4¾	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
De Tamble H	1150	36.0	Tour'g..	5	4	1¾	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
De Tamble J	1200	36.0	Fd. Tg.	5	4	4¾	4½	Pairs .	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
De Tamble K	1675	10.0	Fd. Tg.	7	4	4¾	4½	Pairs..	Tubular.	Cent 'fl	H. T...	Dry....	Splash..
Firestone Colum' 86-C	.....	32.0	F.door..	5	4	4½	4½	Pairs..	Cellular..	Cent 'fl	L. T....	Dry....	Pump..
Firestone Colum' 86-C	.....	42.0	F. door.	5	4	4½	5	Pairs..	Cellular..	Cent 'fl	H. T...	Dry....	Pump..

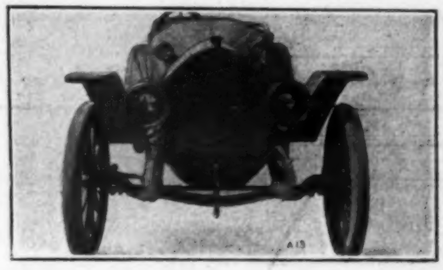
ABBOTT-DETROIT—Abbott Motor Car Co., Detroit, Mich.
ALPENA-FLYER—Alpena Motor Car Co., Alpena, Mich.
ARBENZ—Scioto Motor Car Co., Chillicothe, O.
AUBURN—Auburn Automobile Co., Auburn, Ind.
ATTERBURY—Atterbury Motor Car Co., Buffalo, N. Y.
BABCOCK—H. H. Babcock Co., Watertown, N. Y.
BERGDOLL—Louis J. Bergdoll Motor Car Co., Philadelphia, Pa.
COLE "30"—Cole Motor Car Co., Indianapolis, Ind.

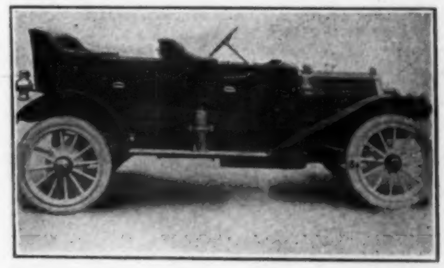
on the American Market for 1911

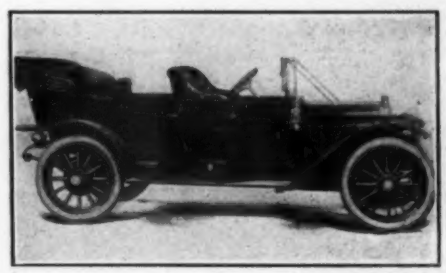
Clutch	TRANSMISSION Type	Speeds	Location	Drive	Wheelbase	Tread	Frame	BEARINGS Crankshaft	Trans-mis'n	Axle	Weight	TIRES Front	Rear
M. Disc...	Sel....	3	Motor...	Shaft....	110	56	P. Steel..	Ball....	Ball...	Roller...	2100	34x3½	34x3½
M. Disc...	Sel....	3	Motor...	Shaft....	110	56	P. Steel..	Ball....	Ball...	Roller...	2100	34x3½	34x3½
M. Disc...	Sel....	3	Motor...	Shaft....	110	56	P. Steel..	Ball....	Ball...	Roller...	2100	34x3½	34x3½
M. Disc...	Sel....	3	Motor...	Shaft....	110	56	P. Steel..	Ball....	Ball...	Roller...	2100	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	110	56½	P. Steel..	Plain...	Ball...	Roller...	2240	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	110	56½	P. Steel..	Plain...	Ball...	Roller...	2240	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft ...	110	56½	P. Steel..	Plain...	Ball...	Roller...	2240	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	110	56½	P. Steel..	Plain...	Ball...	Roller...	2240	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	112	56	Channel.	Plain...	Ball...	Ball....	2250	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	112	56	Channel.	Plain...	Ball...	Ball....	2250	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	112	56	Channel.	Plain...	Ball...	Ball....	2250	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	112	56	Channel.	Plain...	Ball...	Ball....	2250	34x3½	34x3½
Cone.....	Sel....	3	Rear....	Shaft....	120	56	P. Steel..	Plain...	Ball...	Ball....	.....	36	36
Cone.....	Sel....	3	Rear....	Shaft....	120	56	P. Steel..	Plain...	Ball...	Ball....	.....	36	36
Cone.....	Sel....	3	Rear....	Shaft....	120	56	P. Steel..	Plain...	Ball...	Ball....	.....	36	36
Disc......	Plane..	2	S. Frame	Chain...	98	56	Ar. Wood	Plain...	Roller.	Ball....	2200	32x2	32x2
Cone.....	Sel....	3	S. Frame	Chain...	100	56	Ar. Wood	Plain...	Roller.	Ball....	2800	34x2½	34x2½
Cone.....	Prog..	3	S. Frame	Chain...	115	62	Ar. Wood	Plain...	Roller.	Roller...	4000	36x3½	36x3½
M. Disc...	Sel....	3	S. Frame	Chain...	138	66	Channel.	Plain...	Roller	Roller...	5600	36x3½	36x4
M. Disc...	Sel....	3	S. Frame	Chain...	156	66	Channel.	Plain...	Roller.	Roller...	6200	36x4	36x3½
M. Disc...	Sel....	3	S. Frame	Chain...	180	66	Channel.	Plain...	Roller.	Roller...	7000	36x5	36x4
Cone.....	Prog..	3	S. Frame	Chain...	115	62	Ar. Wood	Plain...	Roller.	Roller...	4500	36x3½	36x4
M. Disc...	Sel ...	3	S. Frame	Chain...	156	66	Ar. Wood	Plain...	Roller.	Roller...	6500	36x4	36x5
Cone.....	Sel....	3	S. Frame	Shaft....	120	56	P. Steel..	Plain...	Ball...	R. & B.	2700	36x3½	36x3½
Cone.....	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	Plain...	Ball...	R. & B.	2650	36x3½	36x3½
Cone.....	Sel....	3	S. Frame	Shaft....	120	56	P. Steel..	Plain...	Ball...	R. & B.	2650	36x3½	36x3½
Cone.....	Sel....	3	S. Frame	Shaft....	120	56	P. Steel..	Plain...	Ball...	R. & B.	2650	36x3½	36x3½
Cone.....	Sel....	3	Unit....	Shaft....	112	56	P. Steel.	Plain...	Ball...	R. & B.	2300	34x3½	34x3½
Plate.....	Plane..	2	Unit....	Chain...	100	56	P. Steel..	Plain...	Plain..	Roller..	2300	32x3½	32x3½
Cone.....	Sel....	3	S. Frame	Shaft....	120	56	P. Steel..	Plain...	Ball...	R. & B.	2300	36x3½	36x3½
M. Disc...	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	Plain...	Plain..	Plain...	.....	36x4½	36x4½
M. Disc...	Sel....	3	Unit....	Shaft....	114	56	P. Steel..	Plain...	Plain..	Plain...	.....	34x4	34x4
M. Disc...	Sel....	3	S. Frame	Shaft....	115	56	Channel.	Ball....	Ball...	Ball....	[1]1450	34x3½	34x3½
M. Disc...	Sel....	3	S. Frame	Shaft....	115	56	Channel.	Ball....	Ball...	Ball....	[1]1450	34x3½	34x3½
M. Disc...	Sel....	3	S. Frame	Shaft....	115	56	Channel.	Ball....	Ball...	Ball....	[1]1450	34x3½	34x3½
M. Disc...	Sel....	3	S. Frame	Shaft....	115	56	Channel.	Ball....	Ball...	Ball....	[1]1450	34x3½	34x3½
M. Disc...	Sel....	3	S. Frame	Shaft....	115	56	Channel.	Ball....	Ball...	Ball....	[1]1450	34x4	34x4
M. Disc...	Sel....	3	S. Frame	Shaft....	115	56	Channel.	Ball....	Ball...	Ball....	[1]1450	34x3½	34x3½
M. Disc...	Sel....	3	S. Frame	Shaft....	115	56	Channel.	Ball....	Ball...	Ball....	[1]1450	34x3½	34x3½
M. Disc...	Sel....	3	S. Frame	Shaft....	115	56	Channel.	Ball....	Ball...	Ball....	[1]1450	34x4	34x4
M. Disc...	Sel....	3	S. Frame	Shaft....	115	56	Channel.	Ball....	Ball...	Ball....	[1]1450	34x4	34x4
Cone.....	Sel....	3	Axle.....	Shaft....	114	56	P. Steel..	Plain...	Roller.	Roller..	2150	34x3½	34x3½
Cone.....	Sel....	3	Axle.....	Shaft....	114	56	P. Steel..	Plain...	Roller.	Roller..	2000	34x3½	34x3½
Cone.....	Sel....	3	Axle.....	Shaft....	124	56	P. Steel..	Plain...	Roller.	Roller..	2400	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	118	56	P. Steel..	Plain...	Ball...	Roller...	2700	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	118	56	P. Steel..	Plain...	Ball...	Roller...	2700	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	118	56	P. Steel..	Plain...	Ball...	Rol er...	2700	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	118	56	P. Steel..	Plain...	Ball...	Roller...	2700	34x4	34x4
Cone.....	Sel....	3	Axle....	Shaft....	106	56	P. Steel..	Plain...	Ball...	Roller...	2100	34x3½	34x3½
Cone.....	Sel....	3	Axle....	Shaft....	112	56	P. Steel..	Plain....	Ball...	B. & R.	2300	32x3½	32x3½
Cone.....	Sel....	3	Axle....	Shaft....	118	56	P. Steel..	Plain...	Ball...	B. & R.	2450	34x3½	34x3½
Cone.....	Sel....	3	Motor...	Shaft....	124	56	P. Steel..	Plain...	Ball...	Roller..	3800	36x4½	36x4½
Cone.....	Sel....	3	Motor...	Shaft....	124	56	P. Steel..	Plain...	Ball...	Roller...	3800	36x4½	36x4½
Cone.....	Sel....	3	Motor...	Shaft....	124	56	P. Steel..	Plain...	Ball...	Roller...	3800	36x4½	36x4½
Cone.....	Sel....	3	Motor...	Shaft....	124	56	P. Steel..	Plain...	Ball...	Roller...	3800	36x4½	36x4½
Cone.....	Sel....	3	Motor...	Shaft....	124	56	P. Steel..	Plain...	Ball...	Roller...	3800	36x4½	36x4½
M. disc...	Sel....	3	S. Frame	Shaft....	115	56	P. Steel..	Plain...	Plain..	Roller...	2100	32x3½	32x3½
M. disc...	Sel....	3	S. Frame	Shaft....	117	56	P. Sttel..	Plain...	Plain..	Roller...	2200	34x3½	34x3½
M. disc...	Sel ...	3	S. Frame	Shaft....	117	56	P. Steel..	Plain...	Plain..	Roller...	2400	36x3½	36x3½
M. disc...	Sel....	3	S. Frame	Shaft....	122	56	P. Steel..	Plain...	Ball...	Roller...	3000	36x4	36x4
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Plain...	Ball...	R. & B.	2000	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Plain...	Ball...	R. & B.	2200	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Plain...	Ball...	R. & B.	2300	34x3½	34x3½
M. Disc...	Sel....	3	Unit....	Shaft....	120	56	P. Steel..	Plain...	Ball...	R. & B.	2700	36x4	36x4
Cone.....	Sel....	3	S. Frame	Shaft....	113	56	P. Steel..	Plain...	Ball...	Ball....	2250	34x4	34x4
Cone.....	Sel....	3	S. Frame	Shaft....	120	56	P. Steel..	Plain...	Ball...	Ball....	2650	34x4	34x4

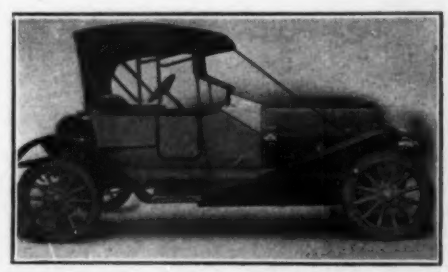
[1] Weight of chassis

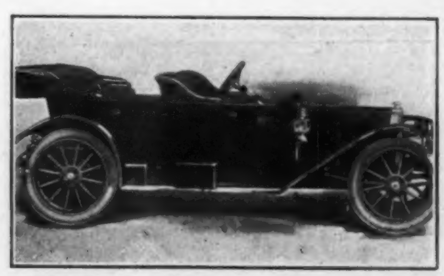
CORREJA—Correja Motor Car Co., New York City.
CLARK "30"—Clark Motor Car Co., Shelbyville, Ind.
CRAWFORD—Crawford Automobile Co., Hagerstown, Md.
CUNNINGHAM—James Cunningham, Son & Co., Rochester, N. Y.
CUTTING—Clarke-Carter Automobile Co., Jackson, Mich.
DE TAMBLE—De Tamble Motors Co., Anderson, Ind.
FIRESTONE-COLUMBUS—Columbus Buggy Co., Columbus, O.


Front view of the Correja

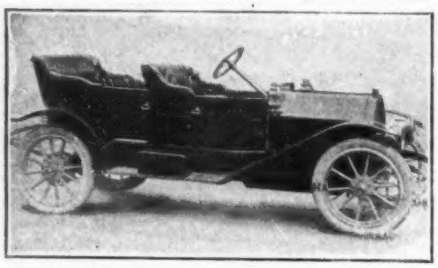

Side view of the Crawford fore-door touring car


Cunningham fore-door touring car

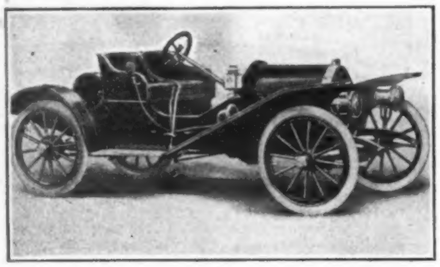

Cutting torpedo with top complete


Firestone-Columbus fore-door touring car

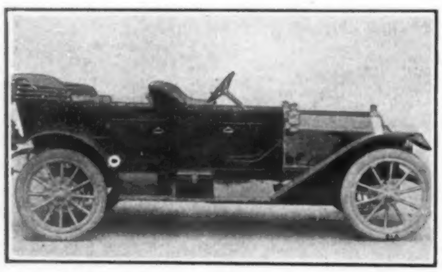
Details of Passenger Automobiles



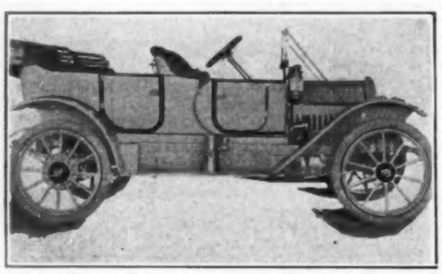
Henry fore-door type of touring car



K-R-I-T roadster type of car



Lexington fore-door touring car



Lion fore-door touring car

Metz type of runabout with top

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY		MOTOR				COOLING		IGNITION		Lubrication
			Type	Seats	Cyl.	Bore Inches	Stroke Inches	Cyl. Cast	Radiator	Pump	Magneto	Battery	
Gaylord	1250	25.6	Utility	4	4	4	5	......	Block...	Pump..	H. T...	Dry....	Pump..
Gaylord	1150	25.6	D. ton..	5	4	4	4½	......	Block...	Pump	H. T...	Dry....	Pump..
Gaylord	1000	22.5	R'ster..	2	4	3¾	4½	......	Block...	Pump.	H. T...	Dry....	Pump..
Gaylord	1250	25.6	Fd. Rr.	2	4	4	5	......	Block...	Pump.	H. T...	Dry....	Pump..
Henry M	1750	27.2	Tour'g..	5	4	4⅛	5¼	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Henry F	1800	27.2	F.d.Tg..	5	4	4⅛	5¼	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Henry P	1750	27.2	To. Rr..	2	4	4⅛	5¼	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Henry K	900	22.5	R'ster..	2	4	3¾	4½	Block.	Tubular.	Syph'n	H. T...	None...	Pump..
Imperial 37	1700	30.6	sd. Tg.	5	4	4⅜	4½	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Pump..
Imperial 33	1700	30.6	Fd. Rr.	4	4	4⅜	4½	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Pump..
Imperial 38	1650	30.6	Tour'g..	4	4	4⅜	4½	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Pump..
Imperial 36	1650	30.6	R'ster..	4	4	4⅜	4½	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Pump..
Imperial 30	1350	28.9	....	5	4	4¼	4½	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Splash..
Imperial 44	1600	30.6	Fd. Tor	5	4	4⅜	4½	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Splash..
Imperial 43	1500	30.6	R'ster..	2	4	4⅜	4½	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Splash..
Imperial 42	1500	30.6	Tour'g..	4	4	4⅜	4½	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Splash..
Imperial 51	2000	30.6	Fd. Rr.	4	4	4⅜	5¼	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Pump..
Imperial 50	2000	....	Fd. Tg.	5	4	4⅜	5¼	Pairs..	Tubular.	Syph'n	H. T...	Dry....	Splash..
Johnson Silent	1600	28.9	Straight	5	4	4¼	4½	Pairs..	H'comb..	Cent'fl	H. T...	....	Splash..
Johnson Silent	2500	32.4	Straight	5	4	4½	5¼	Pairs..	H'comb..	Cent'fl	H. T...	....	Splash..
Johnson Silent	3000	40.0	Tour'g..	7	4	5	5½	Pairs..	H'comb..	Cent'fl	H. T...	....	Splash..
Krit	800	22.5	R'bout.	2	4	3¾	4	Block.	Tubular.	Syph'n	H. T...	....	Splash..
Krit	825	22.5	R'ster..	3	4	3¾	4	Block.	Tubular.	Syph'n	H. T...	....	Splash..
Krit	850	22.5	Tour'g..	3	4	3¾	4	Block.	Tubular.	Syph'n	H. T...	....	Splash..
Krit	1275	22.5	Coupe..	3	4	3¾	4	Block.	Tubular.	Syph'n	H. T...	....	Splash..
Lexington A	2500	36.1	Tour'g..	7	4	4¾	5	Single	Tubular.	Gear..	H. T...	Storage	Pump..
Lexington A	2500	36.1	F.d.Tg.	7	4	4¾	5	Single.	Tubular.	Gear..	H. T...	Storage	Pump..
Lexington A	2500	36.1	Limous.	7	4	4¾	5	Single.	Tubular	Gear..	H. T...	Storage	Pump..
Lexington D	1650	32.4	Tour'g.	5	4	4½	5	Single.	Tubular.	Gear..	H. T...	Dry....	Pump..
Lexington D	1650	32.4	F.d.Tg.	5	4	4½	5	Single.	Tubular.	Gear..	H. T...	Dry....	Pump..
Lexington E	1650	32.4	To. Rr..	2	4	4½	5	Single.	Tubular.	Gear..	H. T...	Dry....	Pump..
Lexington E	1650	32.4	Torp'o..	4	4	4½	5	Single.	Tubular.	Gear..	H. T...	Dry....	Pump..
Lexington F	1850	32.4	Tour'g..	5	4	4½	5	Single.	Tubular.	Gear..	H. T...	Dry....	Pump..
Lion "40" A	1500	32.4	....	5	4	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Pump..
Lion "40" B	1475	32.4	....	4	4	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Pump..
Lion "40" C	1450	32.4	....	2	4	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Pump..
Lion "40" D	1600	32.4	F. door.	5	4	4½	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Pump..
McFarlan Six 32	2500	38.4	Tour'g..	7	6	4	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
McFarlan Six 34	2500	38.4	Torp'o..	4	6	4	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
McFarlan Six 36	2500	38.4	R'bout.	2	6	4	5	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
McFarlan Six 26	2100	31.6	Tour'g..	5	6	3⅝	4	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	F. feed.
McFarlan Six 28	2100	31.6	Tour'g..	4	6	3⅝	4	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	F. feed.
McFarlan Six 30	2100	31.6	R'bout.	2	6	3⅝	4	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	F. feed.
Metz	485	8.7	R'bout.	2	2	3 1/16	3½	Single.	Air coold	......	H. T...	....	Splash..
Norwalk	1600	25.6	Tour'g.	5	4	4	5	Single	Tubular.	Cent'fl	H. T...	....	Splash..
Norwalk	1700	25.6	Vestib..	4	4	4	5	Single	Tubular.	Cent'fl	H. T...	....	Splash..
Norwalk	1700	25.6	R'ster..	2	4	4	5	Single	Tubular	Cent'fl	H. T...	....	Splash..
The Only Car A	800	10.5	Racy...	2	1	5⅛	10	Single.	Tubular.	......	H. T...	Dry....	F. feed.
The Only Car F	1050	10.5	Tour'g..	4	1	5⅛	10	Single.	Tubular.	......	H. T...	Dry...	F. feed.
Otto A	1950	28.9	R'ster..	3	4	4¼	4½	Pairs..	H'comb.	Cent'fl	H. T...	Battery	Pump..
Otto B	2000	28.9	D. ton..	4	4	4¼	4½	Pairs..	H'comb..	Cent'fl	H. T...	Battery	Pump..
Otto C	2000	28.9	Tour'g..	5	4	4¼	4½	Pairs..	H'comb..	Cent'fl	H. T...	Battery	Pump..
Paige Detroit	800	22.5	R'ster..	2	4	3¾	4	Block.	Tubular.	None..	H. T...	None...	Pump..
Paige Detroit	900	22.5	Surrey..	4	4	3¾	4	Block.	Tubular.	None..	H. T...	None...	Pump..
Parry 25	900	19.6	R'bout.	2	4	3½	3¾	Pairs..	Tubular.	Syph'n	H. T...	None ..	Splash..
Parry 43	1300	28.9	R'ster..	4	4	4¼	4½	Pairs..	Tubular.	Cent'fl	H. T...	Dry....	Splash..
Parry 42	1350	28.9	Tour'g..	5	4	4¼	4½	Pairs..	Tubular.	Cent'fl	H. T...	Dry.....	Splash..
Parry 39	1500	28.9	R'ster...	4	4	4¼	4½	Pairs..	Tubular.	Cent'fl	H. T...	None...	Splash..
Parry 37	1500	28.9	D. ton..	4	4	4¼	4½	Pairs..	Tubular.	Cent'fl	H. T...	None...	Splash..
Parry 44	1600	28.9	Tour'g..	5	4	4¼	4½	Pairs..	Tubular.	Cent'fl	H. T...	None...	Splash..
Parry 46	1850	32.4	Torp'o..	5	4	4½	4½	Pairs..	Tubular.	Cent'fl	H. T...	None...	Splash..
Paterson A	1295	25.6	Tour'g..	5	4	4	4	Pairs..	Tubular.	None..	L. T....	Dry....	Splash..
Paterson B	1295	25.6	D. ton..	4	4	4	4	Pairs..	Tubular.	None..	L. T....	Dry....	Splash..
Paterson C	1175	25.6	T'bout..	4	4	4	4	Pairs..	Tubular.	None..	L. T....	Dry....	Splash..
Paterson E	1425	25.6	F. door.	4	4	4	4	Pairs..	Tubular.	None..	L. T....	Dry....	Splash..
Paterson F	1200	25.6	R'ster ..	2	4	4	4	Pairs.	Tubular.	None..	L. T....	Dry....	Splash..
Paterson G	1550	28.9	Tour'g..	5	4	4¼	4½	Pairs..	Tubular.	Cent'fl	L. T....	Dry....	Splash..
Paterson H	1600	28.9	F.d.Tg..	5	4	4¼	4½	Pairs.	Tubular.	Cent'fl	L. T....	Dry....	Splash.

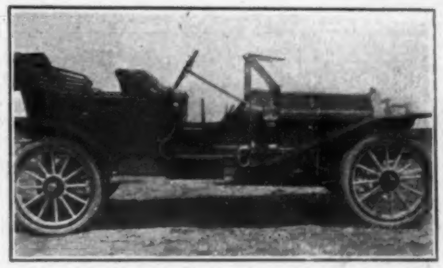
GAYLORD—Gaylord Motor Car Co., Gaylord, Mich.
HENRY—Henry Motor Sales Co., Muskegon, Mich.
IMPERIAL—Imperial Automobile Co., Jackson, Mich.
K-R-I-T—K-R-I-T Motor Car Co., Detroit, Mich.
LEXINGTON—Lexington Motor Car Co., Connersville, Ind.
LION—Lion Motor Sales Co., Detroit, Mich.
McFARLAN—McFarlan Motor Car Company, Connersville, Ind.

on the American Market for 1911

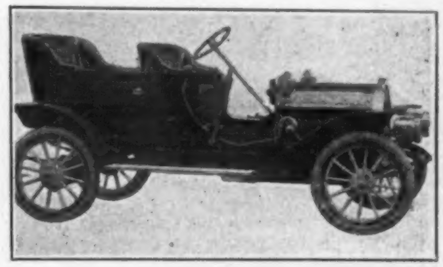
Clutch	Transmission Type	Speeds	Location	Drive	Wheelbase	Tread	Frame	Bearings Crankshaft	Bearings Transmis'n	Bearings Axle	Weight	Tires Front	Tires Rear
M. Disc	Sel	3	Axle	Shaft	112	56	P. Steel	....	....	Roller	.....	32x3½	32x3½
M. Disc	Sel	3	Axle	Shaft	106	56	P. Steel	....	....	Roller	.....	32x3½	32x3½
M. Disc	Sel	3	Axle	Shaft	106	56	P. Steel	....	....	Roller	.....	32x3½	32x3½
M. Disc	Sel	3	Axle	Shaft	112	56	P. Steel	....	....	Roller	.....	36x3½	36x3½
M. Disc	Sel	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Ball	2550	34x4	34x4
M. Disc	Sel	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Ball	2550	34x4	34x4
M. Disc	Sel	3	Unit	Shaft	116	56	P. Steel	Plain	Ball	Ball	2550	34x4	34x4
M. Disc	Sel	3	Axle	Shaft	106	56	P. Steel	Plain	Ball	Roller	1800	32x3½	32x3½
Cone	Sel	3	Motor	Shaft	112	56	P. Steel	....	Roller	Roller	.....	34x3½	34x3½
Cone	Sel	3	Motor	Shaft	112	56	P. Steel	....	Roller	Roller	.....	34x3½	34x3½
Cone	Sel	3	Motor	Shaft	112	56	P. Steel	....	Roller	Roller	.....	34x3½	34x3½
Cone	Sel	3	Motor	Shaft	112	56	P. Steel	....	Roller	Roller	.....	34x3½	34x3½
Cone	Sel	3	Motor	Shaft	106	56	P. Steel	....	Roller	Roller	.....	32x3½	32x3½
Disc	Sel	3	Motor	Shaft	115	56	P. Steel	....	Roller	Roller	.....	34x3½	34x3½
Disc	Sel	3	Motor	Shaft	115	56	P. Steel	....	Roller	Roller	.....	34x3½	34x3½
Disc	Sel	3	Motor	Shaft	115	56	P. Steel	....	Roller	Roller	.....	34x3½	34x3½
Cone	Sel	3	Motor	Shaft	118	56	P. Steel	....	Roller	Roller	.....	34x4	34x4
Cone	Sel	3	Motor	Shaft	118	56	P. Steel	....	Roller	Roller	.....	34x4	34x4
Cone	Sel	3	Unit	Shaft	112	56	P. Steel	Plain	Plain	Ball	.....	34x3½	34x3½
Cone	Sel	3	Unit	Shaft	112	56	P. Steel	Plain	Plain	Ball	.....	34x4	34x4
Cone	Sel	3	Unit	Shaft	124	56	P. Steel	Plain	Plain	Ball	.....	36x4½	36x4½
M. Disc	Sel	2	Motor	Shaft	96	56	P. Steel	Ball	Ball	Ball	1200	32x3	32x3
M. Disc	Sel	2	Motor	Shaft	96	56	P. Steel	Ball	Ball	Ball	1250	32x3	32x3
M. Disc	Sel	2	Motor	Shaft	96	56	P. Steel	Ball	Ball	Ball	1250	32x3	32x3
M. Disc	Sel	2	Motor	Shaft	96	56	P. Steel	Ball	Ball	Ball	1250	32x3	32x3
Cone	Sel	3	S. Frame	Shaft	122	56	P. Steel	Plain	Ball	Roller	3150	36x4½	36x4½
Cone	Sel	3	S. Frame	Shaft	122	56	P. Steel	Plain	Ball	Roller	3150	36x4½	36x4½
Cone	Sel	3	S. Frame	Shaft	122	56	P. Steel	Plain	Ball	Roller	3150	36x4½	36x4½
Cone	Sel	3	S. Frame	Shaft	117	56	P. Steel	Plain	Ball	Ball	2750	34x3½	34x3½
Cone	Sel	3	S. Frame	Shaft	117	56	P. Steel	Plain	Ball	Ball	2800	34x3½	34x3½
Cone	Sel	3	S. Frame	Shaft	117	56	P. Steel	Plain	Ball	Ball	2500	34x3½	34x3
Cone	Sel	3	S. Frame	Shaft	117	56	P. Steel	Plain	Ball	Ball	2650	34x3½	34x3
Cone	Sel	3	S. Frame	Shaft	122	56	P. Steel	Plain	Ball	Ball	2850	34x4	34x4
Cone	Sel	3	Unit	Shaft	112	56	P. Steel	Plain	Roller	Roller	2460	36x3½	36x3½
Cone	Sel	3	Unit	Shaft	112	56	P. Steel	Plain	Roller	Roller	2350	36x3½	36x3½
Cone	Sel	3	Unit	Shaft	112	56	P. Steel	Plain	Roller	Roller	2250	36x3½	36x3½
Cone	Sel	3	Unit	Shaft	112	56	P. Steel	Plain	Roller	Roller	2600	36x3½	36x3½
M. disc	Sel	3	Unit	Shaft	128	56	P. Steel	Plain	Ball	Ball	3000	36x4	36x4
M. disc	Sel	3	Unit	Shaft	128	56	P. Steel	Plain	Ball	Ball	3000	36x4	36x4
M. disc	Sel	3	Unit	Shaft	128	56	P. Steel	Plain	Ball	Ball	3000	36x4	36x4
M. disc	Sel	3	Unit	Shaft	120	56	P. Steel	Plain	Plain	B. & R.	2650	36x4	36x4
M. disc	Sel	3	Unit	Shaft	120	56	P. Steel	Plain	Plain	B. & R.	2650	36x4	36x4
M. disc	Sel	3	Unit	Shaft	120	56	P. Steel	Plain	Plain	B. & R.	2650	36x4	36x4
....	Frit'n.	...	Unit	2 Chain	81	[2]48	Channel	Plain	Ball	Ball	750	28x3	28x3
Cone	Sel	3	Unit	Shaft	117	56	P. Steel	Plain	Roller	Ball	.....	36x3½	36x3½
Cone	Sel	3	Unit	Shaft	117	56	P. Steel	Plain	Roller	Ball	.....	36x3½	36x3½
Cone	Sel	3	Unit	Shaft	117	56	P. Steel	Plain	Roller	Ball	.....	36x3½	36x3½
Cone	Sel	3	Axle	Shaft	104	56	P. Steel	Ball	Ball	Ball	1700	29x3½	29x3½
Cone	Sel	3	Axle	Shaft	104	56	P. Steel	Ball	Ball	Ball	1900	32x3½	32x3½
Cone	Sel	3	Axle	Shaft	123	56	P. Steel	Plain	Ball	Ball	2200	34x3½	34x3½
Cone	Sel	3	Axle	Shaft	123	56	P. Steel	Plain	Ball	Ball	2300	34x3½	34x3½
Cone	Sel	3	Axle	Shaft	123	56	P. Steel	Plain	Ball	Ball	2400	34x4	34x4
M. disc	Sel	2	Unit	Shaft	90	56	P. Steel	Plain	Plain	Roller	.....	32x3	32x3
M. disc	Sel	3	Unit	Shaft	104	56	P. Steel	Plain	Ball	Roller	.....	32x3½	32x3½
Cone	Sel	2	Unit	Shaft	100	56	P. Steel	Plain	Roller	Roller	1700	32x3	32x3
Cone	Sel	3	S. Frame	Shaft	116	[1]56	P. Steel	Plain	Roller	Roller	2300	32x3½	32x3½
Cone	Sel	3	S. Frame	Shaft	116	56	P. Steel	Plain	Roller	Roller	2300	32x3½	32x3½
Cone	Sel	3	S. Frame	Shaft	116	[1]56	P. Steel	Plain	Roller	Roller	2300	32x3½	32x3½
Cone	Sel	3	S. Frame	Shaft	116	[1]56	P. Steel	Plain	Roller	Roller	2300	34x3½	34x3½
Cone	Sel	3	S. Frame	Shaft	118	[1]56	P. Steel	Plain	Roller	Roller	2300	36x3½	36x3½
Cone	Sel	3	S. Frame	Shaft	118	[1]56	P. Steel	Plain	Roller	Roller	2300	36x3½	36x3½
Cone	Sel	3	Unit	Shaft	106	56	P. Steel	Plain	Ball	Ball	2000	32x3½	32x3½
Cone	Sel	3	Unit	Shaft	106	56	P. Steel	Plain	Ball	Ball	2000	32x3½	32x3½
Cone	Sel	3	Unit	Shaft	106	56	P. Steel	Plain	Ball	Ball	2000	32x3½	32x3½
Cone	Sel	3	Unit	Shaft	110	56	P. Steel	Plain	Ball	Ball	2000	34x3½	34x3½
Cone	Sel	3	Unit	Shaft	106	56	P. Steel	Plain	Ball	Ball	2000	32x3½	32x3½
Cone	Sel	3	Unit	Shaft	118	56	P. Steel	Plain	Ball	Ball	2800	34x4	34x4
Cone	Sel	3	Unit	Shaft	118	56	P. Steel	Plain	Ball	Ball	2800	34x4	34x4

[1] Or 60 inches. [2] Or 56 inches.

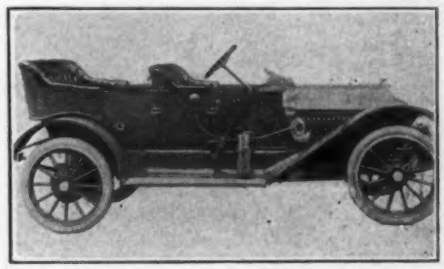
METZ—Metz Co., Waltham, Mass.
NORWALK "35"—Norwalk Motor Car Co., Norwalk, O.
THE ONLY CAR—Only Car Co., New York City.
OTTO—Otto Gas Engine Works, Philadelphia, Penna.
PAIGE-DETROIT—Paige-Detroit Motor Car Co., Detroit, Mich.
PARRY—Parry Automobile Co., Indianapolis, Ind.
PATERSON—W. A. Paterson Co., Flint, Mich.



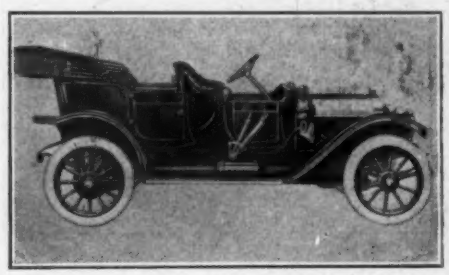
Parry touring car without fore-door



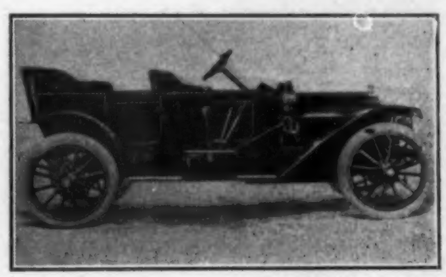
Paterson regular touring car



Imperial fore-door touring car

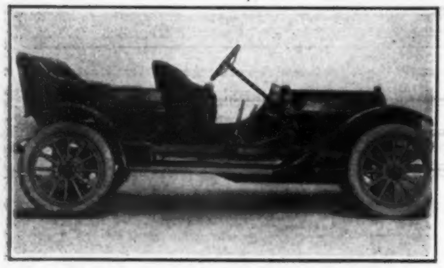


Babcock fore-door type of touring car

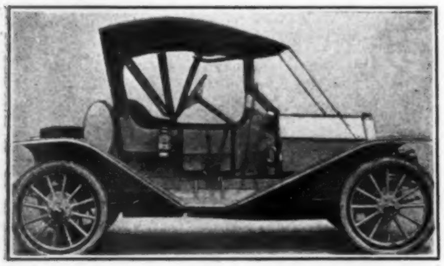


Auburn fore-door type of touring car

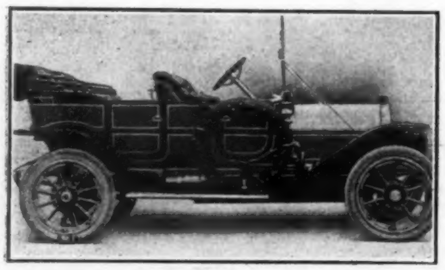
Details of Passenger Automobiles



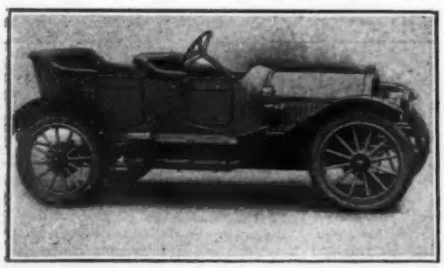
Schacht standard type of touring car



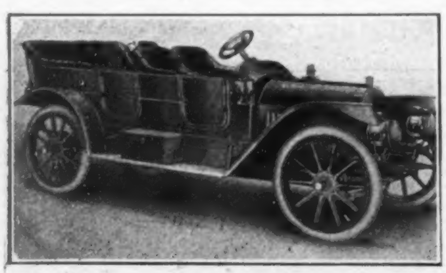
Staver-Chicago fore-door roadster type



Velie fore-door type of touring car



Warren-Detroit fore-door type of touring car



Washington fore-door type of touring car

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY		MOTOR				COOLING		IGNITION		Lubrication
			Type	Seats	Cyl.	Bore Inches	Stroke Inches	Cyl. Cast	Radiator	Pump	Magneto	Battery	
Penn "Thirty" R	$975	25.6	R'ster.	2	4	4	4½	Block.	Tubular.	Syph'n	H. T.	Dry	Pump
Penn "Thirty" T	1075	25.6	Lt. Tg.	4	4	4	4½	Block.	Tubular.	Syph'n	H. T.	Dry	Pump
Penn "Thirty" D	1075	25.6	Lt. del.	4	4	4	4½	Block.	Tubular.	Syph'n	H. T.	Dry	Pump
Petrel 25	850	22.5	Torp'o.	2	4	3¾	4½	Pairs.	Tubular.	Syph'n	H. T.	Dry	Pump
Petrel 35	1000	22.5	Torp'o.	4	4	3¾	4½	Pairs.	Tubular.	Syph'n	H. T.	Dry	Pump
Petrel 40	1350	30.6	R'ster.	2	4	4⅜	4¾	Pairs.	Tubular.	Gear.	H. T.	Dry	Pump
Petrel 45	1500	30.6	T. ton.	4	4	4⅜	4¾	Pairs.	Tubular.	Gear.	H. T.	Dry	Pump
Petrel 55	1500	30.6	Tour'g.	5	4	4⅜	4¾	Pairs.	Tubular.	Gear.	H. T.	Dry	Pump
Petrel 65	1600	30.6	T. ton.	4	4	4⅜	5¼	Pairs.	Tubular.	Cent 'fl	H. T.	Dry	Pump
Petrel 75	1600	30.6	Torp'o.	5	4	4⅜	5¼	Pairs.	Tubular.	Cent 'fl	H. T.	Dry	Pump
Roader "20"	650	21.0	Roader.	2	4	3⅝	3⅝	Block.	Tubular[1]	Syph'n	H. T.	None	Splash
Roader "30"	750	25.6	Roader.	2	4	4	4½	Block.	Tubular[1]	Syph'n	H. T.	None	Splash
Schacht	1400	28.9	Tour'g.	7	4	4¼	5	Block.	H'comb.	Cent 'fl	H. T.	Dry	Pump
Schacht AA	1385	28.9	Tour'g.	7	4	4¼	5	Block.	H'comb.	Cent 'fl	H. T.	Dry	Splash
Schacht M	1335	28.9	R'bout.	3	4	4¼	5	Block.	H'comb.	Cent 'fl	H. T.	Dry	Splash
Staver-Chicago 30-T	1450	25.6	Tour'g.	5	4	4	4	Pairs.	Cellular.	Cent 'fl	L. T.	Dry	Pump
Staver-Chicago 35-R	1650	30.6	Tor. Rr.	2	4	4⅜	5	Block.	Cellular.	Cent 'fl	L. T.	Dry	Splash
Staver-Chicago 35-RR	1650	30.6	R. Rr.	2	4	4⅜	5	Block.	Cellular.	Cent 'fl	L. T.	Dry	Splash
Staver-Chicago 35-T	1650	30.6	Tour'g.	5	4	4⅜	5	Block.	Cellular.	Cent 'fl	L. T.	Dry	Splash
Staver-Chicago 40-B	1850	32.4	F.d.Tg.	5	4	4½	5	Block.	Cellular.	Cent 'fl	L. T.	Dry	Splash
Staver-Chicago 40-C	2500	32.4	Coupe.	4	4	4½	5	Block.	Cellular.	Cent 'fl	L. T.	Dry	Splash
Staver-Chicago 40-T	1850	32.4	O. Tour	7	4	4½	5	Block.	Cellular.	Cent 'fl	L. T.	Dry	Splash
Staver-Chicago 40-F	2000	32.4	F.d.Tg.	7	4	4½	5	Block.	Cellular.	Cent 'fl	L. T.	Dry	Splash
Staver-Chicago 40-L	3250	32.4	Limous.	7	4	4½	5	Block.	Cellular.	Cent 'fl	L. T.	Dry	Splash
Velie 40-G	1800	32.4	Tour'g.	5	4	4½	5¼	Pairs.	H'comb.	Cent 'fl	H. T.	Dry	Pump
Velie 40-G1	2000	32.4	F.d.Tg.	5	4	4½	5¼	Pairs.	H'comb.	Cent 'fl	H. T.	Dry	Pump
Velie 40 H1	2000	32.4	R'ster.	2	4	4½	5¼	Pairs.	H'comb.	Cent 'fl	H. T.	Dry	Pump
Velie 40 1	1800	32.4	T.ton.	4	4	4½	5¼	Pairs.	H'comb.	Cent 'fl	H. T.	Dry	Pump
Velie 40 GLL	3000	32.4	Limous.	7	4	4½	5¼	Pairs.	H'comb.	Cent 'fl	H.T.	Dry	Pump
Washington	2250	27.2	R'ster.	2	4	4⅛	5½	Pairs.	Tubular.	Cent 'fl	H. T.	Dry	Pump
Washington	2250	27.2	T. ton.	4	4	4⅛	5½	Pairs.	Tubular.	Cent 'fl	H. T.	Dry	Pump
Washington	2250	27.2	T. ton.	6	4	4⅛	5½	Pairs.	Tubular.	Cent 'fl	H. T.	Dry	Pump
Washington	2250	27.2	Tour'g.	5	4	4⅛	5½	Pairs.	Tubular.	Cent 'fl	H. T.	Dry	Pump
Washington	2250	27.2	Tour'g.	7	4	4⅛	5½	Pairs.	Tubular.	Cent 'fl	H. T.	Dry	Pump
Warren-Detroit "30"													
11-A	1200	25.6	R'ster.	3	4	4	4½	Block.	Tubular.	Cent 'fl	H. T.	Dry	Splash
11-B	1300	25.6	D.ton.	4	4	4	4½	Block.	Tubular.	Cent 'fl	H. T.	Dry	Splash
11-C	1325	25.6	Tour'g.	5	4	4	4½	Block.	Tubular.	Cent 'fl	H. T.	Dry	Splash
11-D	1200	25.6	R'ster.	2	4	4	4½	Block.	Tubular.	Cent 'fl	H. T.	Dry	Splash
11-E	1750	25.6	Coupe.	2	4	4	4½	Block.	Tubular.	Cent 'fl	H. T.	Dry	Splash
11-F	1500	25.6	Torp'o.	4	4	4	4½	Block.	wubular.	Cent 'fl	H. T.	Storage	Splash
11-G	1500	25.6	F.d.Tg.	5	4	4	4½	Block.	Tubular.	Cent 'fl	H. T.	Storage	Splash
11-H	1300	25.6	Deliv'ry	2	4	4	4½	Block.	Tubular.	Cent 'fl	H. T.	Dry	Splash
11-I	1300	25.6	Deliv'ry	2	4	4	4½	Block.	Tubular.	Cent 'fl	H. T.	Dry	Splash

[1]With cellular features

PENN "30"—Penn Motor Car Co., East Liberty, Penna.
PETREL—Petrel Motor Car Co., Milwaukee, Wis.
ROADER—Roader Car Co., Brockton, Mass.
SCHACHT—Schacht Motor Car Co., Cincinnati, O.

In the Struggle for Perfection—The ideal thermal efficiency of an internal-combustion motor is not far from 38 per cent.; in other words, when 38 per cent. of all the heat units contained in the gasoline are converted into mechanical work the fortunate builder will have accomplished his task, leaving nothing more for designers to do as long as they hold to the Otto-cycle motor. In the meantime laboratory results under the most favorable conditions are on a basis of about 28 per cent. of the thermal efficiency, but in actual practice under the most favorable conditions this thermal efficiency falls off to perhaps 18 per cent. Under poor conditions of operation, especially as automobiles are driven in congested districts, the thermal efficiency is frequently as low as 12 per cent., but if the thermic relations of the functional members of the motor are awry, the thermal efficiency may then sink to perhaps 8 per cent. The immediate need under the circumstances is in the direction of the improvement of the relations such as will bring about a better average performance

on the American Market for 1911

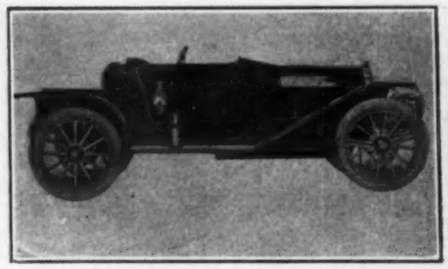
Clutch	Transmission: Type	Transmission: Speeds	Transmission: Location	Transmission: Drive	Wheelbase	Tread	Frame	Bearings: Crankshaft	Bearings: Transmis'n	Bearings: Axle	Weight	Tires: Front	Tires: Rear
Cone	Sel.	3	Unit	Shaft	105	56	P. Steel	Plain	Roller	Roller	1775	32x3½	32x3½
Cone	Sel.	3	Unit	Shaft	105	56	P. Steel	Plain	Roller	Roller	1850	32x3½	32x3½
Cone	Sel.	3	Unit	Shaft	105	56	P. Steel	Plani	Roller	Roller	1900	32x3½	32x3½
None	Frict'n	...	Unit	2 Chains	96	56	P. Steel	Plain	Plain	Ball	1550	32x3	32x3
None	Frict'n	...	Unit	2 Chains	96	56	P. Steel	Plain	Plain	Ball	1625	32x3	33x3½
None	Frict'n	...	Unit	2 Chains	108	56	P. Steel	Plain	Plain	Ball	2000	34x3½	34x3½
None	Frict'n	...	Unit	2 Chains	115	56	P. Steel	Plain	Plain	Ball	2300	34x3½	34x3½
None	Frict'n	...	Unit	2 Chains	115	56	P. Steel	Plain	Plain	Ball	2400	34x3½	34x3½
None	Frict'n	...	Unit	2 Chains	118	56	P. Steel	Plain	Plain	Ball	2500	34x3½	34x3½
None	Frict'n	...	Unit	2 Chains	118	56	P. Steel	Plain	Plain	Ball	2500	34x3½	34x3½
Cone	Sel.	2	Axle	Shaft	104	56	P. Steel	Plain	Plain	Ball	1350	34x3	34x3
Cone	Sel.	2	Axle	Shaft	104	56	P. Steel	Plain	Plain	Ball	1500	34x3	34x3
Cone	Sel.	3	Unit	Shaft	120	56	P. Steel	Plain	Roller	Ball	2350	34x4	34x4
Cone	Sel.	3	Motor	Shaft	120	[2]56	P. Steel	Plain	Roller	Roller	2250	34x3½	34x3½
Cone	Sel.	3	Motor	Shaft	110	56	P. Steel	Plain	Roller	Roller	2100	34x3½	34x3½
M. Disc	Sel.	3	Unit	Shaft	112	56	P. Steel	Plain	Ball	Ball	2150	34x3½	34x3½
Disc	Sel.	3	Unit	Shaft	117	56	P. Steel	Plain	Ball	Ball	2400	34x3½	34x3½
Disc	Sel.	3	Unit	Shaft	117	56	P. Steel	Plain	Ball	Ball	2200	34x3½	34x3½
Disc	Sel.	3	Unit	Shaft	117	56	P. Steel	Plain	Ball	Ball	2500	35x4	35x4
Disc	Sel.	3	Unit	Shaft	117	56	P. Steel	Plain	Ball	Ball	.....	35x4	35x4
Disc	Sel.	3	Unit	Shaft	117	56	P. Steel	Plain	Ball	Ball	.....	35x4	35x4
Disc	Sel.	3	Unit	Shaft	124	56	P. Steel	Plain	Ball	Ball	.....	36x4	36x4
Disc	Sel.	3	Unit	Shaft	124	56	P. Steel	Plain	Ball	Ball	2750	35x4	36x4
Disc	Sel.	3	Unit	Shaft	124	56	P. Steel	Plain	Ball	Ball	2850	36x4½	36x4½
Disc	Sel.	3	Unit	Shaft	115	56	P. Steel	Plain	Roller	Roller	2800	34x4	34x4
Disc	Sel.	3	Unit	Shaft	115	56	P. Steel	Plain	Roller	Roller	2850	34x4	34x4
Disc	Sel.	3	Unit	Shaft	115	56	P. Steel	Plain	Roller	Roller	2500	34x4	34x4
Disc	Sel.	3	Unit	Shaft	115	56	P. Steel	Plain	Roller	Roller	2600	34x4	34x4
Disc	Sel.	3	Unit	Shaft	115	56	P. Steel	Plain	Roller	Roller	3400	35x4½	35x4½
M. disc	Sel.	4	Unit	Shaft	118	56	P. Steel	Plain	Roller	Roller	2975	36x4	36x4
M. disc	Sel.	4	Unit	Shaft	118	56	P. Steel	Plain	Roller	Roller	2975	36x4	36x4
M. disc	Sel.	4	Unit	Shaft	118	56	P. Steel	Plain	Roller	Roller	2975	36x4	36x4
M. disc	Sel.	4	Unit	Shaft	118	56	P. Steel	Plain	Roller	Roller	2975	36x4	36x4
M. disc	Sel.	4	Unit	Shaft	118	56	P. Steel	Plain	Roller	Roller	2975	36x4	36x4
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Plain	Ball	2150	34x3½	34x3½
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Plain	Ball	2200	34x3½	34x3½
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Plain	Ball	2200	34x3½	34x3½
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Plain	Ball	2150	34x3½	34x3½
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Plain	Ball	2350	35x4	35x4
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Plain	Ball	2200	35x4	35x4
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Plain	Ball	2250	35x4	35x4
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Plain	Ball	2250	33x4	33x4
Cone	Sel.	3	Unit	Shaft	110	56	P. Steel	Plain	Plain	Ball	2300	33x4	33x4

[2]Or 60 inches

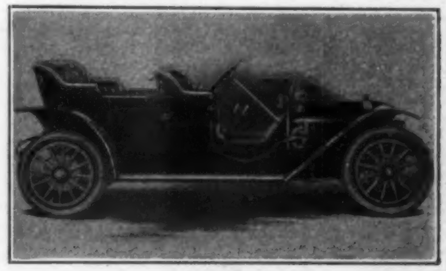
STAVER-CHICAGO—Staver Carriage Co., Chicago, Ill.
VELIE—Velie Motor Vehicle Co., Moline, Ill.
WASHINGTON—Carter Motor Car Corp., Washington, D. C.
WARREN-DETROIT—Warren Motor Car Co., Detroit, Mich.

of automobile motors, and to a considerable extent it is for the users of automobiles to know something about the thermal functions and be on their guard against poor relations which are likely to obtain when more attention is given to the polishing of the brass work than is accorded the machinery equipment.

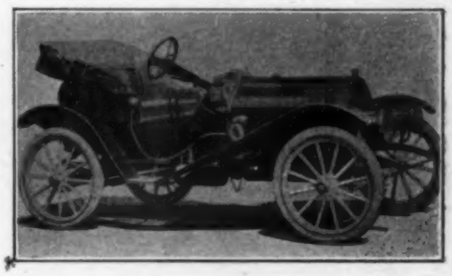
In the purchase of an automobile, then, while it is proper to learn how to handle the clutch, apply the brakes and adjust the spark and throttle control, there still remains the little detail of becoming acquainted with the motor and the methods of use that will appease the thermal relations. It is sheer nonsense for a man, even though he may not be a machinist, to maintain that he cannot familiarize himself with the details of design of a simple automobile sufficiently for him to adjust the carbureter, regulate the spark, look after the lubrication, and, if necessary, time the valves. It is even possible for him to grind the valves from time to time in order that they may be tight; unless they are tight the result will be poor; a loss of power is inevitable.



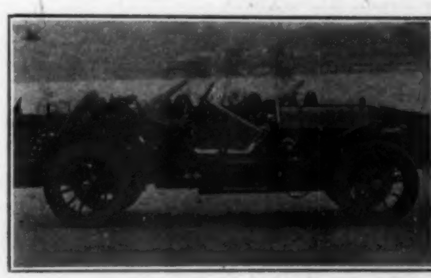
Clark torpedo type of roadster



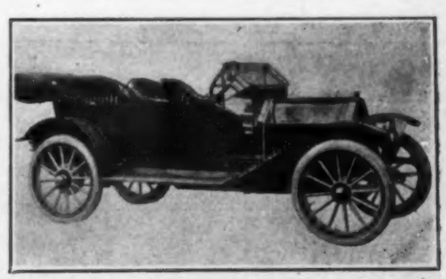
Otto type C touring car



Paige-Detroit, roadster

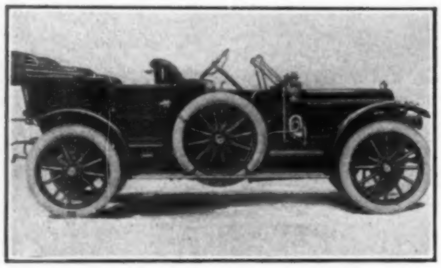


Velie smart type of roadster

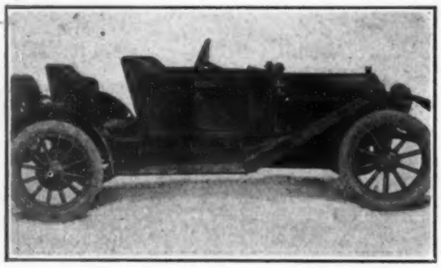


Norwalk 35 fore-door four-passenger torpedo

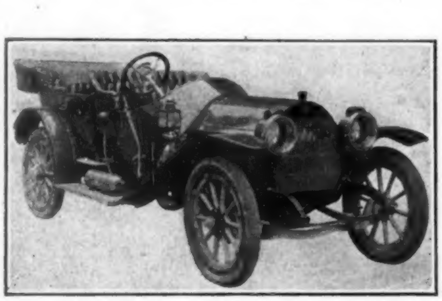
Details of Passenger Automobiles



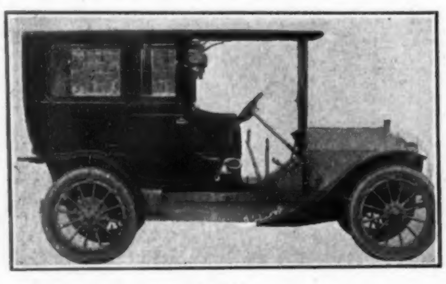
Rambler fore-door type of touring car



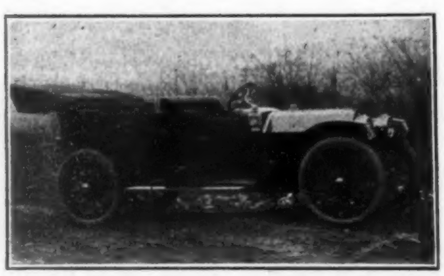
F. A. L. fore-door car with rumble



Carhartt demi-tonneau



Dorris town limousine



KlineKar fore-door touring car

BESIDES the automobiles that were tabulated as exhibiting at the Garden Palace under the banner of the A. M. C. M. E. A., there are quite a the practice of Thomas B. Jeffery Company, of Kenosha, Wis., to conduct twenty-four makes that are here tabulated, the majority of the models named in most cases the agents are fortified to the extent of having the assistance of good cheer as the season affords.

It is claimed by some of these makers that a better chance may be had and should the occasion arise, it is also possible to conduct a demonstration. and discussed with comfort and without loss of time. Many of the sales rooms the agents are receiving much support from the friends who know the qualities have been patrons in the past, but who may desire to join the ever-swelling ranks.

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY		MOTOR				COOLING		IGNITION		Lubrication
			Type	Seats	Cyl.	Bore inches	Stroke inches	Cyl. Cast	Radiator	Pump	Magneto	Battery	
Black Crow 10	$1000	25.6	R'bout.	2	4	4	4½	Block.	H'comb.	None.	H. T.	Dry	Mech.
Black Crow 11	1100	25.6	Surrey.	2	4	4	4½	Block.	H'comb	None.	H. T.	Dry	Mech.
Black Crow 12	1150	25.6	D.ton.	2	4	4	4½	Block.	H'comb	None.	H. T.	Dry	Mech.
Black Crow 13	1300	27.2	Tour'g	5	4	4¼	4½	Pairs.	H'comb	None.	H. T.	Dry	Mech.
Black Crow 15	1500	28.9	Torp'o	5	4	4¼	4½	Pairs.	H'comb.	None.	H. T.	Dry	Mech.
Black Crow 16	1650	30.6	R'bout.	2	4	4⅜	5	Pairs.	H'comb	None.	H. T.	Dry	Mech.
Black Crow 17	1750	30.6	Torp'o.	5	4	4⅜	5	Pairs.	H'comb	None.	H. T.	Dry	Mech.
Black Crow 20	2000	30.6	Torp'o.	7	4	4⅜	5	Pairs.	H'comb.	None.	H. T.	Dry	Mech.
Carhartt B	2250	28.9	Tour'g.	5	4	4½	4½	Pairs.	H'comb.	Cent'fl	H. T.	Storage	F. feed.
Carhartt C	2250	28.9	R'bout.	2	4	4½	4½	Pairs.	H'comb.	Cent'fl	H. T.	Storage	F. feed.
Carhartt E	2250	28.9	D. ton.	4	4	4½	4½	Pairs.	H'comb.	Cent'fl	H. T.	Storage	F. feed.
Carhartt J	1100	25.0	R'ster.	3	4	4	4	Pairs.	H'comb.	Cent'fl	H. T.	Dry	F. feed.
Cino	2250	34.2	Tour'g.	5	4	4⅝	5	Pairs.	Tubular.	Cent'fl	H. T.	Dry	Splash.
Derain	4000	....	Tour'g.	5	4	5	5½	Pairs.	Tubular.	Cent'fl	H. T.	....	Pump.
Derain	....	....	R'bout.	2	4	5	5½	Pairs.	Tubular.	Cent'fl	H. T.	....	Pump.
Derain	....	....	Tour'g.	7	4	5	5½	Pairs.	Tubular	Cent'fl	H. T.	....	Pump.
Dorris F	2500	30.6	Tour'g.	5	4	4⅜	5	Pairs.	Tubular.	Cent'fl	H. T.	Dry	Splash.
Dorris F	2500	30.6	R'ster.	2	4	4⅜	5	Pairs.	Tubular.	Cent'fl	H. T.	Dry	Splash.
Dorris F	3600	30.6	Limous.	7	4	4⅜	5	Pairs.	Tubular.	Cent'fl	H. T.	Dry	Splash.
Dorris F	2650	30.6	Coupe.	2	4	4⅜	5	Pairs.	Tubular.	Cent'fl	H. T.	Dry	Splash.
Empire "Twenty" C	950	19.6	R'ster.	2	4	3½	4	Block.	Tubular.	None.	L. T.	None.	Splash.
Falcar N	1850	27.2	F.d. Tg.	5	4	4⅛	5¼	Pairs.	Tubular.	Cent'fl	H. T.	Dry	Pump.
Falcar N	1850	27.2	T. ton.	4	4	4⅛	5¼	Pairs.	Tubular	Cent'fl	H. T.	Dry	Pump.
Falcar N	1850	27.2	F.d.Rr.	3	4	4⅛	5¼	Pairs.	Tubular.	Cent'fl	H. T.	Dry	Pump.
Falcar N	1850	27.2	Speed.	2	4	4⅛	4¼	Pairs.	Tubular.	Cent'fl	H. T.	Dry	Pump.
Fuller Special "A"	2000	36.0	Tour'g.	7	4	4¾	5	Single.	Cellular.	Gear.	H. T.	Dry	Splash.
Fuller "A"	1600	32.0	Tour'g.	4	4	4½	5	Single.	Cellular.	Gear.	H. T.	Dry	Splash.
Fuller "A-2"	1350	25.0	Tour'g.	4	4	4	4	Single.	Cellular.	Gear.	H. T.	Dry	Splash.
Fuller "F" Special	1000	25.0	R'ster.	3	4	4	4	Single.	Cellular.	Gear.	H. T.	Dry	Splash.
G.J.G. Junior	1000	....	R'bout.	2	4	4¾	5	Pairs.	H'comb.	Cent'fl	H. T.	None.	Splash.
G.J.G. Pirate	2500	....	R'ster.	2	4	4¾	5	Pairs.	H'comb.	Cent'fl	H. T.	None.	Spalsh.
G.J.G. Scout	2500	....	Torp'o.	4	4	4¾	5	Pairs.	H'comb.	Cent'fl	H. T.	None.	Spalsh.
G.J.G. Comfort	2500	....	Tour'g.	5	4	4¾	5	Pairs.	H'comb.	Cent'fl	H. T.	None.	Splash.
G.J.G. Carryall	2750	....	Carryall	7	4	4¾	5	Pairs.	H'comb.	Cent'fl	H. T.	None.	Splash.
Great Smith	2500	32.4	Torp'o.	4	4	4½	5	Single.	Cellular.	Gear.	H. T.	Dry	Splash.
Great Smith	2500	32.4	T. ton.	4	4	4½	5	Single.	Cellular.	Gear.	H. T.	Dry	Spalsh.
Great Smith	2500	32.4	Tour'g.	5	4	4½	5	Single.	Cellular.	Gear.	H. T.	Dry	Splash.
Great Smith	2500	32.4	R'bout.	2	4	4½	5	Single.	Cellular.	Gear.	H. T.	Dry	Splash.
Great Western Forty	1600	28.9	Tour'g.	5	4	4¼	5	Sep.	Tubular.	Cent'fl	H. T.	Dry	Automatic
Great Western Forty	1600	28.9	D. ton.	4	4	4¼	5	Sep.	Tubular.	Cent'fl	H. T.	Dry	
Great Western Forty	1650	28.9	Fore-D.	5	4	4¼	5	Sep.	Tubular.	Cent'fl	H. T.	Dry	
Great Western Forty	1600	28.9	R'ster.	2	4	4¼	5	Sep.	Tubular.	Cent'fl	H. T.	Dry	
Great Western Forty	1750	28.9	Torp'o.	4	4	4¼	5	Sep.	Tubular.	Cent'fl	H. T.	Dry	

BLACK CROW—Otto F. Rost, 1593 Broadway, New York City.
CARHARTT—Carhartt Auto Sales Co., Hotel Plaza, New York City.
CINO—Haberer & Co., Cincinnati, O.
DERAIN—Derain Motor Co., Cleveland, O.
DORRIS—Dorris Motor Car Co., St. Louis, Mo.
EMPIRE—Empire Motor Car Co., Indianapolis, Ind.

If the automobile pulls hard and the motor seems to be in good order, slack off upon the brakes.

on the American Market for 1911

under the banner of the A. L. A. M., and the cars that are on show at the number of automobile makers who are showing in private. It has always been a private exhibition in New York City, and this year is no exception. Of the may be examined at the sales rooms of the New York representatives, and the maker's sales staff, with an extended corps of trained assistants and such

to examine the automobiles at the showrooms than is possible at the shows, Moreover there is a greater degree of privacy so that business can be taken up are fitted out in the most elaborate way and it is not too much to say that of their wares, and welcome is invariably extended to not only those who The addresses of the private exhibitors are given below the tabulations.

Clutch	TRANSMISSION Type	Speeds	Location	Drive	Wheelbase	Tread	Frame	BEARINGS Crankshaft	Trans-mis'n	Axle	Weight	TIRES Front	Rear
M. Disc...	Sel....	3	R. Axle .	Shaft....	109	56	P. Steel..	Plain...	Roller.	Roller...	.....	32x3	32x3½
M. Disc ..	Sel....	3	R. Axle .	Shaft....	109	56	P. Steel..	Plain...	Rcller.	Roller...	.....	32x3	32x3½
M. Disc...	Sel....	3	R. Axle .	Shaft....	109	56	S. Pteel..	Plain...	Roller.	Rcller...	.....	32x3	32x3½
M. Disc...	Sel....	3	R. Axle .	Shaft....	112	56	P. Steel..	Plain...	Roller.	Rcller...	.....	32x3½	32x3½
M. Disc...	Sel....	3	R. Axle .	Shaft....	112	56	P. Steel..	Plain...	Roller.	Rcller...	.....	34x3½	34x3½
M. Disc...	Sel....	3	R. Axle .	Shaft....	120	56	P. Steel..	Plain...	Roller.	Roller...	.....	34x3½	34x3½
M. Disc ..	Sel....	3	R. Axle .	Shaft....	120	56	P. Steel..	Plain...	Rcller.	Rcller...	.....	34x4	34x4
M. Disc...	Sel....	3	R. Axle .	Shaft....	120	56	P. Steel..	Plain...	Roller.	Roller...	.....	36x4	36x4
M. Disc...	Sel....	3	S. Frame	Shaft....	118	56	P. Steel..	Plain...	Ball...	Roller...	2800	34x4	34x4
M. Disc...	Sel....	3	S. Frame	Shaft....	118	56	P. Steel .	Plain...	Ball...	Roller...	2600	34x4	34x4
M. Disc...	Sel....	3	S. Frame	Shaft....	118	56	P. Steel..	Plain...	Ball...	Roller...	2700	34x4	34x4
Cone.....	Sel....	3	S. Frame	Shaft....	108	56	P. Steel..	Plain...	Ball...	Roller...	1800	23x3	23x3½
Cone.....	Sel....	3	Amid'p..	Shaft....	113	56	P. Steel..	Plain...	Ball...	Roller..	2890	34x4	34x4
Cone.....	Sel....	3	....	Shaft....	125½	56	P. Steel .	Plain...	Ball...	Ball....	.....	36x4	36x5
Cone.....	Sel....	3	....	Shaft....	125½	56	P. Steel..	Plain...	Ball...	Ball....	.....	36x4	36x5
Cone.....	Sel....	3	....	Shaft....	125½	56	P. Steel..	Plain...	Ball...	Ball....	.....	36x4	36x5
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Plain...	Roller.	Roller..	2950	36x4	36x4
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Plain...	Roller.	Roller..	2700	36x4	36x4
M. Disc...	Sel ...	3	Unit....	Shaft....	115	56	P. Steel..	Plain...	Roller.	Roller..	3100	36x4	36x4
M. Disc...	Sel....	3	Unit....	Shaft....	115	56	P. Steel..	Plain. .	Roller.	Roller..	3000	36x4	36x4
Cone.....	Sel....	3	Axle.....	Shaft....	96	56½	P. Steel..	Plain...	Ball...	Roller..	1575	32x3½	32x3½
Cone.....	Sel.....	3	Unit....	Shaft....	115½	56	P. Steel..	Plain...	Ball...	Ball....	2650	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	115½	56	P. Steel..	Plain...	Ball...	Ball....	2650	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	115½	56	P. Steel..	Plain...	Ball...	Ball....	2650	34x4	34x4
Cone.....	Sel....	3	Unit....	Shaft....	115½	56	P. Steel..	Plain...	Ball...	Ball....	2650	34x4	34x4
M. Disc...	P. or S.	3	S. Frame	Shaft....	118	56	P. Steel..	Plain...	Rcller.	Roller..	2500	34x4	34x4
M. Disc...	P. or S.	3	S. Frame	Shaft....	115	56	P. Steel..	Plain...	Rcller.	Roller..	2200	33x4	33x4
M. Disc...	Plane..	2	S. Frame	Shaft....	110	56	P. Steel..	Plain...	Plain..	Roller..	2000	32x3½	32x3½
M. Disc...	Plane..	2	S. Frame	Shaft....	100	56	P. Steel..	Plain...	Plain..	Roller..	1700	31x3½	31x3½
Cone.....	Sel....	3	Arrid p..	Shaft....	104	56	P. Steel..	Plain...	Plain..	Roller..	1400	32x3½	32x3½
Cone.....	Sel....	3	S. Frame	Shaft....	121	56	P. Steel..	Plain...	Ball...	Ball....	2600	34x4	34x4
Cone.....	Sel....	3	S. Frame	Shaft....	121	56	P. Steel..	Plain...	Ball...	Pall....	2600	34x4	34x4
Cone.....	Sel....	3	S. Frame	Shaft....	121	56	P. Steel..	Plain...	Ball...	Ball....	2600	34x4	34x4
Cone.....	Sel....	3	S. Frame	Shaft....	121	56	P. Steel..	Plain...	Ball...	Ball....	2600	34x4	34x4
M. Disc...	Sel....	3	Frame...	Shaft....	115	56	P. Steel..	Plain...	Roller.	Roller..	2500	36x4	36x4
M. Disc...	Sel....	3	Frame...	Shaft....	115	56	P. Steel..	Plain...	Roller.	Roller..	2500	36x4	36x4
M. Disc...	Sel....	3	Frame...	Shaft....	115	56	P. Steel..	Plain...	Roller.	Roller..	2600	36x4	36x4
M. Disc...	Sel....	3	Frame...	Shaft....	110	56	P. Steel..	Plain...	Roller.	Roller..	2450	36x4	36x4
Cone.....	Sel....	3	Arrid p..	Shaft....	114	56	P. Steel..	Plain...	Roller.	Roller..	2200	34x3½	34x3½
Cone.....	Sel....	3	Amid'p..	Shaft....	114	56	P. Steel..	Plain...	Roller.	Roller..	2150	34x3½	34x3½
Cone.....	Sel....	3	Amid'p..	Shaft....	114	56	P. Steel..	Plain...	Roller.	Roller..	2250	34x3½	34x3½
Cone.....	Sel....	3	Amid'p..	Shaft....	114	56	P. Steel..	Plain...	Roller.	Roller..	2050	34x3½	34x3½
Cone.....	Sel....	3	An id'p..	Shaft....	114	56	P. Steel..	Plain...	Roller.	Roller..	2300	35x4	35x4

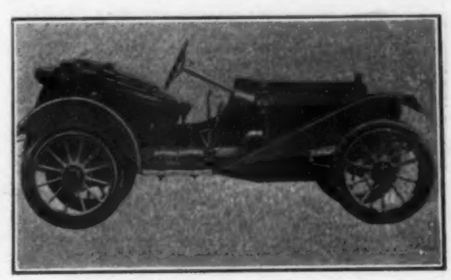
F. A. L. CAR—F. A. L. Motor Co., Chicago, Ill.
FULLER—Fuller Buggy Co., Jackson, Mich.
G. J. G.—G. J. G. Motor Car Co., White Plains, N. Y.
GREAT SMITH—Smith Automobile Co., Topeka, Kan.
GREAT WESTERN—Great Western Automobile Co., Peru, Ind.

If noise is being made and it is hard to find, apply grease to all the bearings.

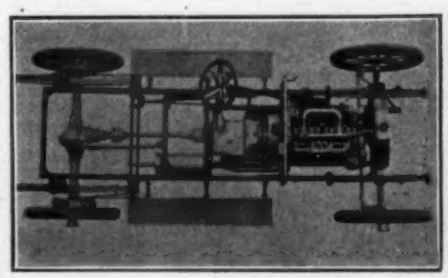
Halladay five-passenger touring car

G. J. G. four-passenger torpedo

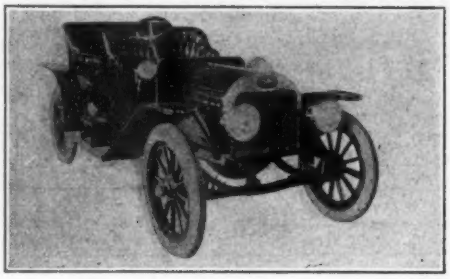
Fuller touring regular car



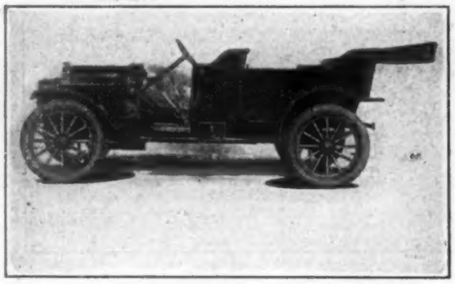
Empire seat-for-two runabout



Cino chassis in plan

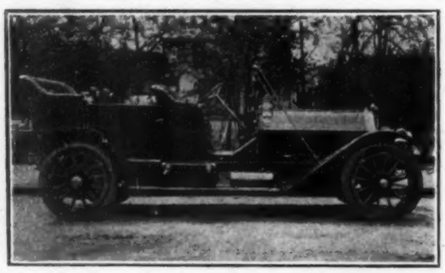


Marathon Fire Chief type of touring car

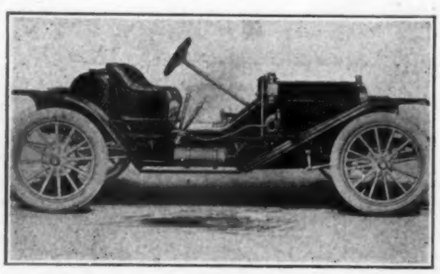


Westcott standard type of touring car

Nance fore-door runabout type



Pittsburgh "six" model D touring car



Black Crow roadster type of car

Details of Passenger Automobiles

MAKE AND MODEL	Price	H.P.A.L.A.M.	BODY Type	BODY Seats	MOTOR Cyl.	MOTOR Bore Inches	MOTOR Stroke Inches	MOTOR Cyl. Cast	COOLING Radi-ator	COOLING Pump	IGNITION Mag-neto	IGNITION Battery	Lubrication
Grout 45-D	$2850	36.1	Fore-D.	7	4	4¾	5	Single	Cellular	Gear	H. T.	Dry	Splash
Grout 45-E	2750	36.1	Tour'g.	7	4	4¾	5	Single	Cellular	Gear	H. T.	Dry	Splash
Grout 45-F	2500	36.1	Tour'g.	5	4	4¾	5	Single	Cellular	Gear	H. T.	Dry	Splash
Grout 45-G	2500	36.1	Tonett.	4	4	4¾	5	Single	Cellular	Gear	H. T.	Dry	Splash
Grout 35-H	1850	32.4	Tour'g.	5	4	4½	5	Single	Tubular	Gear	H. T.	Dry	Splash
Grout 35-I	1850	32.4	Tonett.	4	4	4½	5	Single	Tubular	Gear	H. T.	Dry	Splash
Halladay	2650	36.1	Limous.	7	4	4¾	5	Single	H'comb.	Gear	H. T.	Dry	Pump
Halladay	2650	36.1	Tour'g.	4	4	4¾	5	Single	H'comb.	Gear	H. T.	Dry	Pump
Halladay	2650	36.1	R'ster.	4	4	4¾	5	Single	H'comb.	Gear	H. T.	Dry	Pump
Halladay	1700	32.4	Limous.	5	4	4½	5	Single	H'comb.	Gear	H. T.	Dry	Pump
Halladay	1700	32.4	Tour'g.	4	4	4½	5	Single	H.comb.	Gear	H. T.	Dry	Pump
Halladay	1700	32.4	R'ster.	4	4	4½	5	Single	H'comb.	Gear	H. T.	Dry	Pump
Halladay	1700	32.4	T. ton.	2	4	4½	5	Single	H.comb.	Gear	H. T.	Dry	Pump
Halladay "J"	1500	25.6	Tour'g.	5	4	4	4	Single	Tubular	Gear	H. T.	Dry	Pump
Halladay "J"	1500	25.6	R'ster.	4	4	4	4	Single	Tubular	Gear	H. T.	Dry	Pump
Halladay "J"	1500	25.6	T. ton.	2	4	4	4	Single	Tubular	Gear	H. T.	Dry	Pump
Halladay "G"	1250	25.6	Tour'g.	5	4	4	4	Single	Tubular	Gear	H. T.	Dry	Pump
Halladay "G"	1250	25.6	R'ster.	3	4	4	4	Single	Tubular	Gear	H. T.	Dry	Pump
Herreshoff 25	950	18.2	R'bout.	3	4	3⅜	3¾	Block	Tubular	Syph'n	H. T.	Dry	Pump
Herreshoff 20-A	1500	18.2	R'bout.	3	4	3⅜	3¾	Pairs	Tubular	Syph'n	H. T.	......	Pump
Herreshoff 20-A	1500	18.2	T'bout.	4	4	3⅜	3¾	Pairs	Tubular	Syph'n	H. T.	......	Pump
Herreshoff 20-B	1500	18.2	Tour'g.	5	4	3⅜	3¾	Pairs	Tubular	Syph'n	H. T.	......	Pump
Kline Kar 4-40	2250	28.9	Tour'g.	5	4	4¼	5¼	Block	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 4-40	2250	28.9	T. ton.	4	4	4¼	5¼	Block	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 4-40	2200	22.5	T. ton.	2	4	4¼	5¼	Block	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 4-24	1500	25.6	R'ster.	2	4	3¾	4½	Sepa.	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 4-30	1675	25.6	Tour'g.	5	4	4	4½	Sepa.	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 4-30	1675	25.6	T. ton.	4	4	4	4½	Sepa.	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 4-30	1600	25.6	R'ster.	2	4	4	4½	Sepa.	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 6-60	3250	43.8	Tour'g.	7	6	4¼	5¼	Block	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 6-60	2950	43.8	R'ster.	2	6	4¼	5¼	Block	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 6-50	2700	40.9	Tour'g.	5	6	4$\frac{3}{32}$	5	Block	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 6-50	2700	40.9	T' ton.	4	6	4$\frac{3}{32}$	5	Block	Cellular	Cent'fl	H. T.	Dry	Pump
Kline Kar 6-50	2650	40.9	R'ster.	2	6	4$\frac{3}{32}$	5	Block	Cellular	Cent'fl	H. T.	Dry	Pump
Marathon	1700	28.9	Tor. Tg.	5	4	4¼	4½	Pairs	Cellular	Syph'n	H. T.	Dry	Splash
Marathon	1500	28.9	Tor. Rr.	2	4	4¼	4½	Pairs	Cellular	Syph'n	H. T.	Dry	Splash
Marathon	1500	28.9	Tour'g.	5	4	4¼	4½	Pairs	Cellular	Syph'n	H. T.	Dry	Splash
Marathon	1500	28.9	R'ster.	2	4	4¼	4½	Pairs	Cellular	Syph'n	H. T.	Dry	Splash
Nance Six	1900	31.6	Tour'g.	5	6	3⅝	4$\frac{1}{16}$	Pairs	H'comb.	Cent'fl	H. T.	Dry	F. feed
Nance Six	1900	31.6	R'bout.	2	6	3⅝	4$\frac{1}{16}$	Pairs	H'comb.	Cent'fl	H. T.	Dry	F. feed
Pittsburg Six D	4000	54.1	Tour'g.	7	6	4¾	5¼	Sepa.	Cellular	Gear	H. T.	Storage	Pump
Pittsburg Six E	4000	54.1	Tour'g.	5	6	4¾	5¼	Sepa.	Cellular	Gear	H. T.	Storage	Pump
Pittsburg Six B	3000	54.1	R'ster.	3	6	4¾	5¼	Sepa.	Cellular	Gear	H. T.	Storage	Pump
Rambler 55	.....	32.4	....	..	4	4½	4½	Sepa.	Rambler	Cent'fl	H. T.	Storage	Mech.
Rambler 63	.....	32.4	Tour'g.	5	4	4½	4½	Sepa.	Rambler	Cent'fl	H. T.	Storage	Mech.
Rambler 64	.....	40.0	....	..	4	5	5½	Sepa.	Rambler	Cent'fl	H. T.	Storage	Mech.
Rambler 65	.....	40.0	....	..	4	5	5½	Sepa.	Rambler	Cent'fl	H. T.	Storage	Mech.
Sharp Arrow	3000	40.0	Tour'g.	5	4	5	5	Pairs	H'comb.	Cent'fl	H. T.	Dry	Splash
Sharp Arrow	2950	40.0	R'bout.	2	4	5	5	Pairs	H'comb.	Cent'fl	H. T.	Dry	Splash
Sterling O-1	1700	23.6	R'ster.	2	4	4	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash
Sterling O-2	1750	23.6	Town.	4	4	4	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash
Sterling O-3	1750	23.6	Tour'g.	5	4	4	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash
Sterling O-4	1850	28.9	Tour'g.	7	4	4¼	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash
Sterling O-5	1800	28.9	Tour'g.	2	4	4¼	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash
Sterling	2000	28.9	Torp'o.	6	4	4¼	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash
Westcott G	2000	....	R'ster.	7	4	4½	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash
Westcott F	2000	....	F.d.Tg.	5	4	4½	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash
Westcott H	2200	....	F.d.Tg.	7	4	4½	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash
Westcott J	2000	....	R'ster.	4	4	4½	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash
Westcott	1000	....	R'ster.	4	4	4½	5	Single	H'comb.	Cent'fl	H. T.	Dry	Splash

GROUT—Grout Automobile Co., Orange, Mass.
HALLADAY—Streator Motor Car Co., Streator, Ill.
HERRESHOFF—Herreshoff Motor Co., Detroit, Mich.
KLINE KAR—B. C. K. Motor Car Co., York, Pa.
MARATHON—Southern Motor Works, Nashville, Tenn.
NANCE—Nance Motor Car Co., Philadelphia, Pa.

As a General Rule—

If the radiator heats, it is due to running on a retarded spark.

If the spark is right and the radiator still heats, it may be due to a leaky pump.

If the pump is working satisfactorily, the chances are that too much gasoline is being used.

on the American Market for 1911

	TRANSMISSION							BEARINGS				TIRES	
Clutch	Type	Speeds	Loca-tion	Drive	Wheelbase	Tread	Frame	Crank-shaft	Trans-mis'n	Axle	Weight	Front	Rear
Cone	Sel	3	Amid'p.	Shaft	123	56	P. Steel	Plain	Roller	Roller	3120	36x4	37x4½
Cone	Sel	3	Amid'p.	Shaft	123	56	P. Steel	Plain	Roller	Roller	3040	36x4	37x4½
Cone	Sel	3	Amid'p.	Shaft	123	56	P. Steel	Plain	Roller	Roller	2957	36x4	36x4
Cone	Sel	3	Amid'p.	Shaft	123	56	P. Steel	Plain	Roller	Roller	2860	36x4	36x4
Cone	Sel	3	Amid'p.	Shaft	116	56	P. Steel	Plain	Roller	Roller	2750	34x4	34x4
Cone	Sel	3	Amid'p.	Shaft	116	56	P. Steel	Plain	Roller	Roller	2700	34x4	34x4
M. Disc	Sel	3	S. Frame	Shaft	128	56	P. Steel	Plain	Ball	Ball	3000	36x4½	36x4½
M. Disc	Sel	3	S. Frame	Shaft	128	56	P. Steel	Plain	Ball	Ball	3000	36x4½	36x4½
M. Disc	Sel	3	S. Frame	Shaft	128	56	P. Steel	Plain	Ball	Ball	3000	36x4½	36x4½
M. Disc	Sel	3	S. Frame	Shaft	118½	[1]56	P. Steel	5 Plain	Ball	Ball	2700	36x3½[1]	36x3½[1]
M. Disc	Sel	3	S. Frame	Shaft	118½	[1]56	P. Steel	5 Plain	Ball	Ball	2700	36x3½[1]	36x3½
M. Disc	Sel	3	S. Frame	Shaft	118½	[1]56	P. Steel	5 Plain	Ball	Ball	2700	36x3½	36x3½
M. Disc	Sel	3	S. Frame	Shaft	118½	[1]56	P. Steel	5 Plain	Ball	Ball	2700	36x3½	36x3½
M. Disc	Sel	3	S. Frame	Shaft	110	[1]56	P. Steel	Plain	Ball	C.& c'ne	2200	36x3½	36x3½
M. Disc	Sel	3	S. Frame	Shaft	110	[1]56	P. Steel	Plain	Ball	C.& c'ne	2200	36x3½	36x3½
M. Disc	Sel	3	S. Frame	Shaft	110	[1]56	P. Steel	Plain	Ball	C.& c'ne	2200	36x3½	36x3½
Cone	Sel	3	Axle	Shaft	104	[1]56	P. Steel	Plain	Ball	Roller	2000	32x3½	32x3½
Cone	Sel	3	Axle	Shaft	104	[1]56	P. Steel	Plain	Ball	Roller	2000	32x3½	32x3½
M. Disc	Sel	3	Motor	Shaft	98	56	P. Steel	Plain	Plain	B. & R.	1200	32x3	32x3
M. Disc	Sel	3	Motor	Shaft	100	56	P. Steel	Ball	Ball	Plain	1500	32x3½	32x3½
M. Disc	Sel	3	Motor	Shaft	100	56	P. Steel	Ball	Ball	Plain	1550	32x3½	32x3½
M. Disc	Sel	3	Motor	Shaft	105	56	P. Steel	Ball	Ball	Plain	1750	32x3½	32x3½
Cone	Sel	3	Amid'p.	Shaft	117	56	P. Steel	Plain	Ball	Ball	2550	36x4	36x4
Cone	Sel	3	Amid'p.	Shaft	117	56	P. Steel	Plain	Ball	Roller	2500	36x4	36x4
Cone	Sel	3	Amid'p.	Shaft	117	56	P. Steel	Plain	Ball	Roller	2450	36x4	36x4
Cone	Sel	3	Amid'p.	Shaft	110	56	P. Steel	Plain	Ball	Roller	1900	34x3½	34x3½
Cone	Sel	3	Amid'p.	Shaft	110	56	P. Steel	Plain	Ball	Roller	2200	34x3½	34x3½
Cone	Sel	3	Amid'p.	Shaft	110	56	P. Steel	Plain	Ball	Roller	2150	34x3½	34x3½
Cone	Sel	3	Amid'p.	Shaft	110	56	P. Steel	Plain	Ball	Roller	2100	34x3½	34x3½
Cone	Sel	4	Amid'p.	Shaft	128	56	P. Steel	Plain	Ball	Ball	3200	38x4	38x4½
Cone	Sel	4	Amid'p.	Shaft	110	56	P. Steel	Plain	Ball	Ball	2600	38x4	38x4
Cone	Sel	3	Amid'p.	Shaft	124	56	P. Steel	Plain	Ball	Roller	2800	36x4	36x4
Cone	Sel	3	Amid'p.	Shaft	124	56	P. Steel	Plain	Ball	Roller	2800	36x4	36x4
Cone	Sel	3	Amid'p.	Shaft	108	56	P. Steel	Plain	Ball	Roller	2550	36x4	36x4
M. Disc	Sel	3	Unit	Shaft	120	56	Channel	Plain	Roller	Roller	2150	35x4	35x4
M. Disc	Sel	3	Unit	Shaft	116	56	Channel	Plain	Roller	Roller	1900	34x3½	34x3½
M. Disc	Sel	3	Unit	Shaft	116	56	Channel	Plain	Roller	Roller	2100	34x3½	34x3½
M. Disc	Sel	3	Unit	Shaft	116	56	Channel	Plain	Roller	Roller	1900	34x3½	34x3½
M. Disc	Sel	3	Unit	Shaft	122	56	P. Steel	Plain	Ball	Ball	2500	34x3½	34x3½
M. Disc	Sel	3	Unit	Shaft	122	56	P. Steel	Plain	Ball	Ball	2350	34x3½	34x3½
M. Disc	Sel	3	Amid'p.	Shaft	134	56	P. Steel	Plain	Ball	Ball	3600	36x4½	36x4½
M. Disc	Sel	3	Amid'p.	Shaft	134	56	P. Steel	Plain	Ball	Ball	3600	36x4½	36x4½
M. Disc	Sel	3	Amid'p.	Shaft	134	56	P. Steel	Plain	Ball	Ball	3600	36x4½	36x4½
M. Disc	Sel	3	Unit	Shaft	112	56	P. Steel	Roller	Roller	Roller	.....	36x4	36x4
M. Disc	Sel	3	Unit	Shaft	112	56	P. Steel	Roller	Roller	Roller	.....	36x4	36x4
M. Disc	Sel	3	Unit	Shaft	120	56	P. Steel	Roller	Roller	Roller	.....	36x4½	36x4½
M. Disc	Sel	3	Unit	Shaft	128	56	P. Steel	Roller	Roller	Roller	.....	40x4½	40x4½
Cone	Sel	3	S. Frame	Shaft	120	56	P. Steel	Plain	Ball	Ball	2850	36x4	36x4
Cone	Sel	3	S. Frame	Shaft	110	56	P. Steel	Plain	Ball	Ball	2650	36x4	36x4
Con.band	Sel	3	Axle	Shaft	118	56	P. Steel	5 Plain	Ball	R. & B.	2250	34x3½	34x4½
Con.band	Sel	3	Axle	Shaft	118	56	P. Steel	5 Plain	Ball	R. & B.	2300	34x3½	34x3½
Con.band	Sel	3	Axle	Shaft	118	56	P. Steel	5 Plain	Ball	R. & B.	2350	34x4	34x4
Con.band	Sel	3	Axle	Shaft	118	56	P. Steel	5 Plain	Ball	R. & B.	2500	34x4	34x4
Con.band	Sel	3	Axle	Shaft	118	56	P. Steel	5 Plain	Ball	R. & B.	2200	34x3	34x4
Con.band	Sel	3	Axle	Shaft	118	56	P. Steel	5 Plain	Ball	R. & B.	2500	36x4	36x4
Cone	Sel	3	S. Frame	Shaft	120	56	P. Steel	Plain	Ball	Roller	3000	36x4	36x4
Cone	Sel	3	S. Frame	Shaft	120	56	P. Steel	Plain	Ball	Roller	3000	36x4	36x4
Cone	Sel	3	S. Frame	Shaft	120	56	P. Steel	Plain	Ball	Roller	3000	36x4	36x4
Cone	Sel	3	S. Frame	Shaft	112	56	P. Steel	Plain	Ball	Roller	2700	34x4	34x4
Cone	Sel	3	S. Frame	Shaft	112	56	P. Steel	Plain	Ball	Roller	2700	34x4	34x4

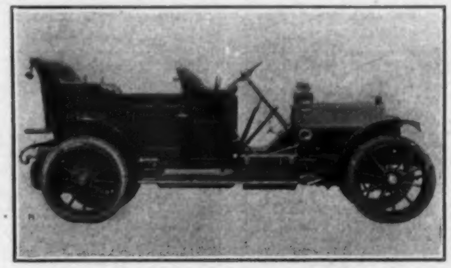
[1]Also 60 inches.

PITTSBURGH—Pittsburgh Motor Car Co., New Kensington, Pa.
RAMBLER—Rambler Automobile Co. of New York, 38 West 62d St., New York City.
SHARP-ARROW—Sharp-Arrow Automobile Co., Trenton, N. J.
STERLING—Elkhart Motor Car Co., Elkhart, Ind.
WESTCOTT—Westcott Motor Car Co., Richmond, Ind.

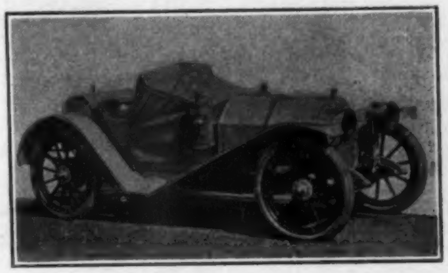
If the supply of gasoline is properly regulated, it may be that the battery is run down.

If the trouble persists, the chances are that the combustion chamber has a thick coating of carbon.

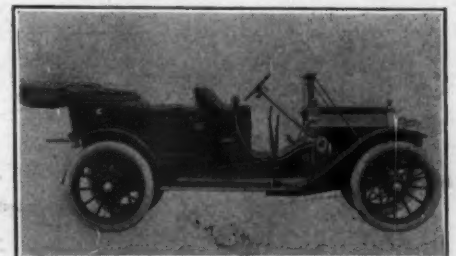
If the combustion chamber is clean, it then remains to blow out the radiator to remove the coating of scale.



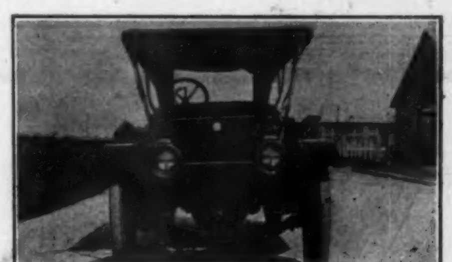
Derain five-passenger touring car



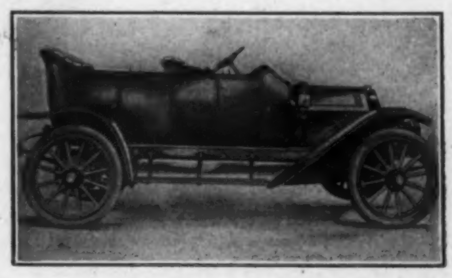
KlineKar Model 6-60



Dorris five-passenger touring car

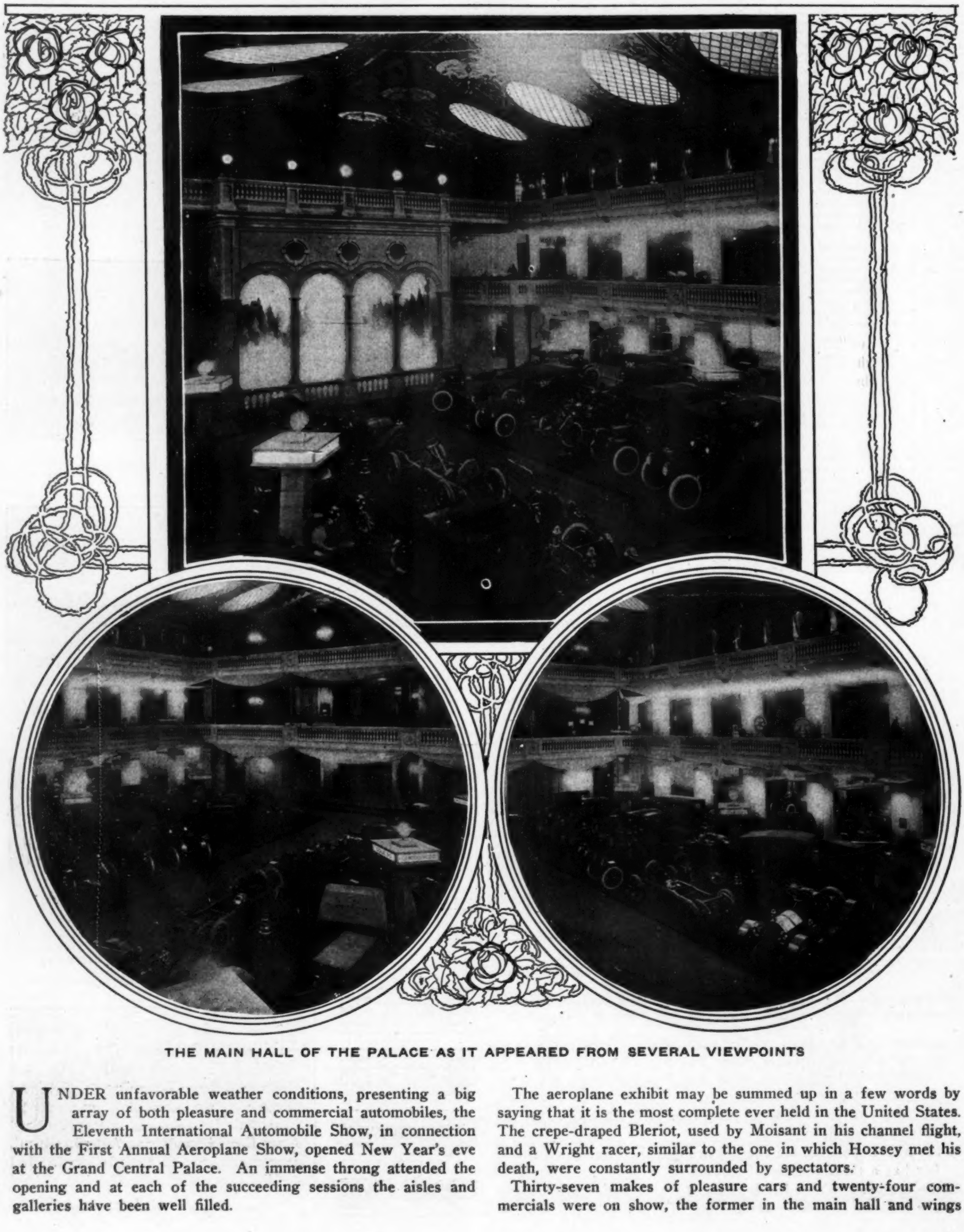


Front view of Halladay touring car



Great Western fore-door torpedo

A·M·C·M·E·A



THE MAIN HALL OF THE PALACE AS IT APPEARED FROM SEVERAL VIEWPOINTS

UNDER unfavorable weather conditions, presenting a big array of both pleasure and commercial automobiles, the Eleventh International Automobile Show, in connection with the First Annual Aeroplane Show, opened New Year's eve at the Grand Central Palace. An immense throng attended the opening and at each of the succeeding sessions the aisles and galleries have been well filled.

The aeroplane exhibit may be summed up in a few words by saying that it is the most complete ever held in the United States. The crepe-draped Bleriot, used by Moisant in his channel flight, and a Wright racer, similar to the one in which Hoxsey met his death, were constantly surrounded by spectators.

Thirty-seven makes of pleasure cars and twenty-four commercials were on show, the former in the main hall and wings

and the latter in the long aisles and alcoves of the floor above.

On the main floor are the pleasure cars and in the aisle leading to the stage are the Isotta, Velie, Cole and Metz on one side and on the other the Michigan, Johnson, Babcock and Imperial.

There hardly is a pleasure car booth in which a fore-door body is not found. Larger tires seem to be popular. The Velie people have a particularly attractive-looking roadster which is designed for speed purposes, while the Abbott-Detroit's coupé body is sufficiently out of the ordinary to attract considerable attention. The Krit has a runabout with an underslung frame and a torpedo body that catches and holds the attention of the public, while a feature on the seven-passenger Johnson, which is prominent because of its originality, is the lighting scheme. The side lamps are electric and are sunk in the dash, being flush with the wood in front and the bulging back being hidden by the fore-door body.

Another tendency seems to be a disposition to make popular the combination car, one that can be used both for business and pleasure. The Penn is one of these and has a chassis which takes any one of three bodies—a touring car, roadster or light commercial wagon—which is made possible by a clever device on the steering column which permits it being raised or lowered to get the desired rake. The Atterbury has a folding starting crank which possesses considerable merit. The Cunningham encloses its valves and rocker arms. Two novelties in the way of three-wheelers are the Kelsey motorette and the Cyklonette.

The Auburn, made by the Auburn Automobile Co., of Auburn, Ind., shows a wheelbase increased from 116 to 120 inches. A cone clutch has been substituted for a disk while three-quarter elliptic instead of elliptic springs are used.

Besides showing a commercial proposition, the H. H. Babcock Co., of Watertown, N. Y., has a line of pleasure cars. It offers two motors, one 4 1-2 by 5 inch and the other 4 1-8 by 5 1-4. The cylinders are cast in pairs and the valve heads are jacketed. Valve noise is cared for by means of 2 1-2-inch valves which lift only 5-16 inch for both exhaust and intake.

The Only Car is a new one at the shows, a one-cylinder proposition which made its début in a contest way last summer. The car has a wheelbase of 104 inches and the motor is placed under the hood, which is long enough to give the car the appearance of a four-cylinder. The bore is 5 1-8 by 10 inches stroke, the horsepower rating being 12. The carbureter is of the three-jet type; thermo-syphon cooling is used and there are two systems of ignition. The oiling is had by a mechanical system and the transmission is of the selective type.

This show also marks the entrance of the Cunningham, made by James Cunningham, Son & Co., of Rochester, N. Y., into the selling field. These veteran carriage makers have produced a car in which the power plant is a feature. A unit construction combines the motor and transmission into one piece. The bore is 4 3-4 and the stroke 5 3-4, while the large valves are set in cages in the cylinder head.

Whereas the Paige-Detroit pinned all its faith last year to a three-cylinder two-cycle proposition, for 1911 the Detroit makers have added to their line a four-cylinder four-cycle motored chassis, in which the bore is 3 3-4 inches and the stroke 4, the same size as the three-cylinder.

Refinement in details marks the Lion, made in Adrian, Mich. This year the car is sold fully equipped and in addition has a larger radiator, heavy fenders, a change in springing and a new model with a fore-door type of body. Four models are offered for the one chassis and the company builds its own motor and transmission, the motor being a 4 1-2 by 5-inch affair and the wheelbase 112 inches.

In the Otto, a Philadelphia-made car, there has been substituted a full floating rear axle in place of the live type one used last year. The spokes in the rear wheel have been bossed, while larger brake drums are used. There is a universal case to the housing and the differential are one-piece and of manganese bronze.

The McFarlan Motor Car Co., of Connersville, Ind., was so well satisfied with its little six last year that it has added a 50-60-horsepower model to this year's line, there being seven different body types for the two chassis.

A year's experience has led the Cole company to add power and strength to its 1911 models. Using a three-point suspension, it has increased the cylinder dimensions from 4 by 4 to 4 1-4 by 4 1-2 inches. Besides it has tipped the motor 2 1-2 degrees with respect to the horizontal, which it claims has jumped the horsepower from 30 to 36. L-type cylinders cast in pairs are used. The wheelbase has been increased from 108 to 118 inches and 34 by 4-inch tires are used instead of 32 by 3 1-2.

Besides commercial cars, the Johnson Service Co., of Milwaukee, makes pleasure cars which are much in evidence at the show. One of the big talking points is the Johnson-Bosch ignition system, which is new in that Johnson has incorporated with the Bosch magneto an accelerator device which is placed on the magneto to facilitate starting. The Johnson people have three motors, one, a 30-horsepower, having a bore and stroke of 4 1-4 by 4 1-2; a second, a 40, a 4 1-2 by 5 1-4, and the third, a 50, having 5 by 5 1-2.

A fore-door idea represents the latest in the line of the W. A. Paterson Co., of Flint, Mich., which this year is making models E and I with a 4 by 4 motor and a wheelbase increased from 106 to 110 inches, and models G and H engined with a 4 1-4 by 4 1-2-inch motor and with a wheelbase of 118 inches.

It is argued by a newcomer, the Penn Motor Car Co., of Pittsburg, that there is a demand for a motor vehicle that can be used for both business and pleasure purposes. This belief has resulted in the production of the Penn chassis which carries interchangeable bodies. It will take either a roadster or touring car body or else a light delivery body can be put on.

The De Tamble Motors Co., of Anderson, Ind., comes to the show with almost a new line—at least everything is new in the four-cylinder group, although the company has carried over its two-cylinder three-passenger runabout which it put out last season. Four models are offered as four-cylinders, the features being an engine with a bore of 4 3-8 inches and a stroke of 4 1-2; three-speed selective gearset, shaft drive, disk clutch, and full floating rear axle. In model K there is a 120-inch wheelbase and 36-inch wheels.

With the Correja Motor Car Co., of New York, the idea takes the form of a runabout. The changes for 1911 show the adoption of a T motor in place of the Renault L-type formerly used.

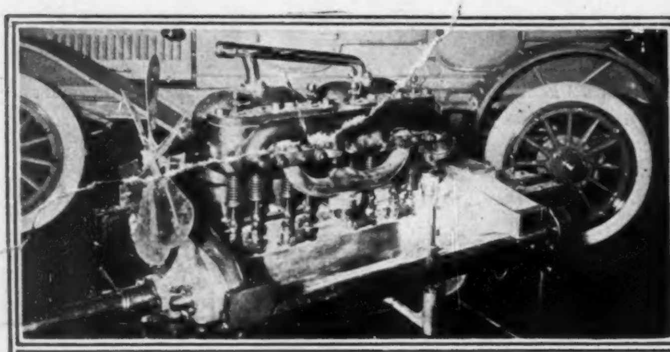
The Norwalk, made by the Norwalk Motor Car Co., of Norwalk O., stands out as an example of three-point suspension, which includes the motor clutch and transmission. Two of these points of suspension are permanent on the radiator support, while the third is on a bearing.

The Clark comes from Indiana—Shelbyville—and the concern making it has been in the industry for six years. The line includes three body styles on two chassis. Models A and B use the Rutenber motor with four individually-cast cylinders, rated at 30 horsepower. This chassis has a multiple-disk clutch, pump circulation in the water system, high-tension magneto and 34 by 3 1-2 wheels on A and B. The wheelbase is 114 inches. The model X has a motor with the cylinders cast en bloc and using a self-contained oiling system, the bore being 4 inches and the stroke 4 1-2. There is a three-bearing crankshaft.

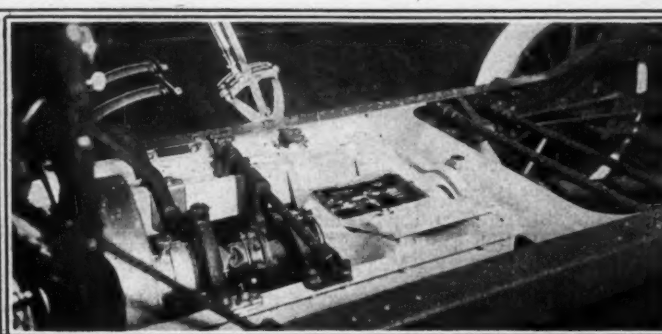
There are two chassis in the Crawford line, made by the Crawford Automobile Co., of Hagerstown, Md., and there are four models. Three of these are offered for the chassis which carries the 4 1-4 by 4 1-2-inch motor, a Continental, which uses splash lubrication, pump cooling and cone clutch. The wheelbase is 110 inches on the two roadsters and 112 on the touring car. The big touring car has a Crawford motor which is 4 1-2 inches square.

This is the first year for the four-cylinder Schacht, made by the Cincinnati concern which entered the motor industry originally with a motor buggy.

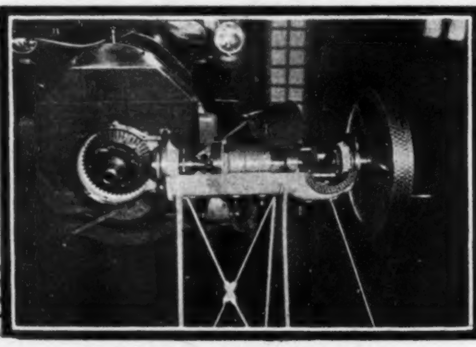
With the exception of model B, the line of the Michigan Buggy



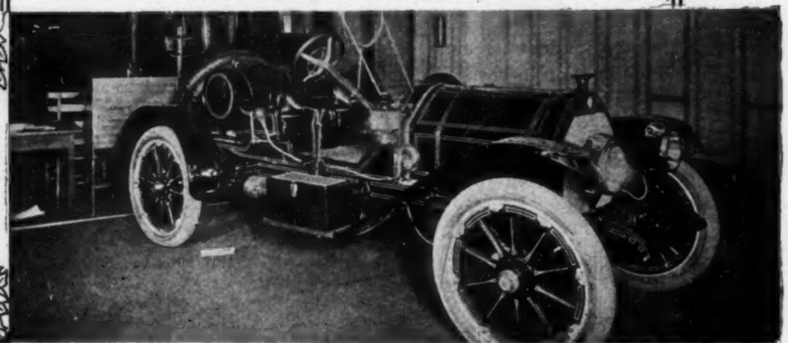
Imperial motor with flat one-piece valve covers



Norwalk chassis, showing three-point suspension.

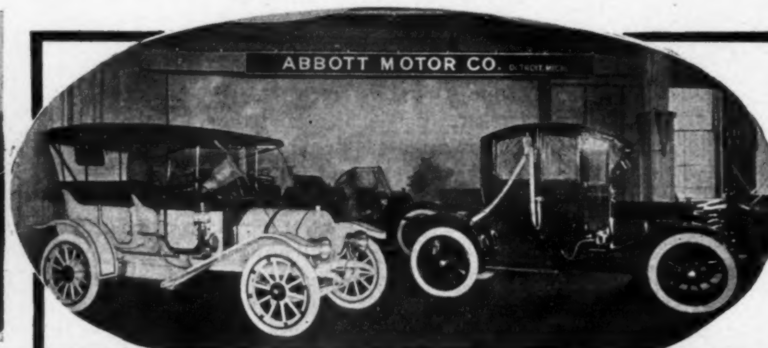


Hart Kraft transmission and power unit

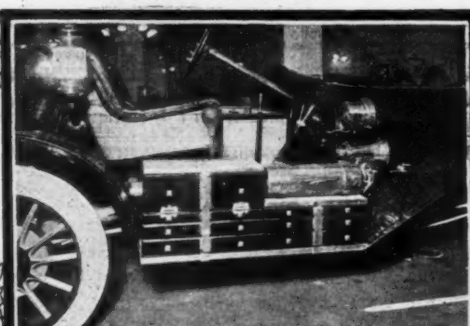


Velie racy type, painted salmon color

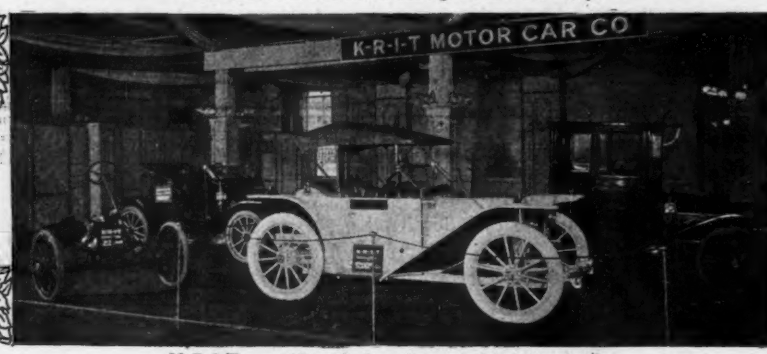
Kelsey three-wheel motorette.



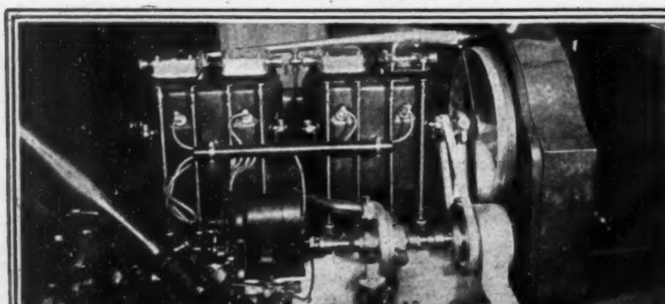
Abbott-Detroit exhibit, including inside drive Coupe



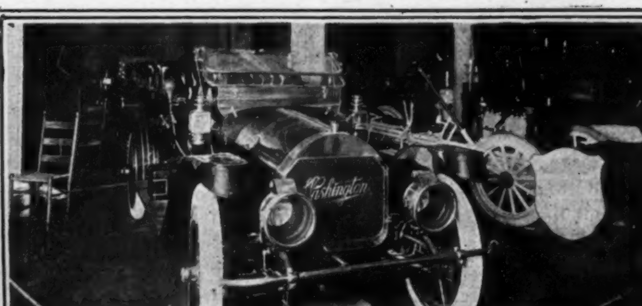
Neat disposition for carrying tools on Henry car



K-R-I-T car with underslung frame and fore-door body



Cunningham motor with overhead valves

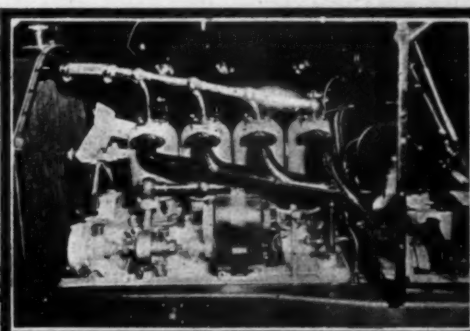


Washington seven-passenger touring model

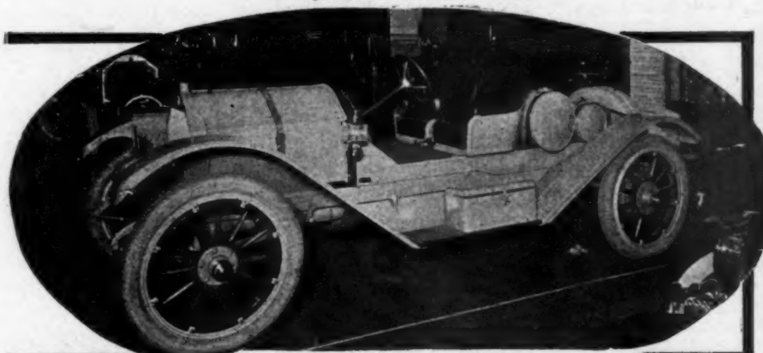
Michigan exhibit in the main hall.

Penn "30" showing runabout and touring models

Auburn Torpedo with outside levers

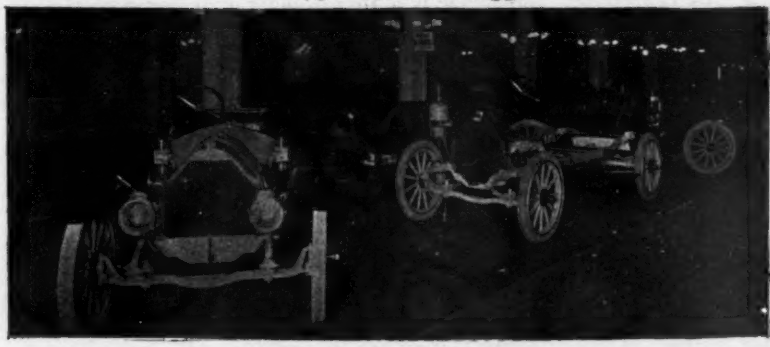


Exhaust side of Norwalk "35" motor

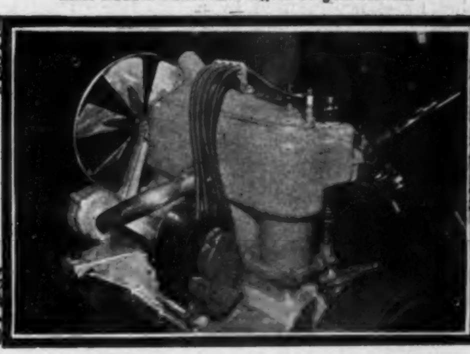


Cole "30," with race-about body

Inset electric dashboard lights on Johnson car

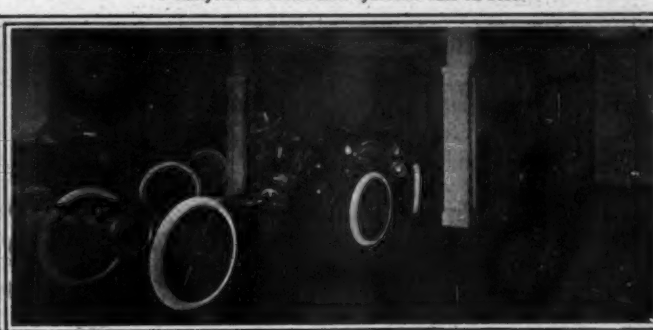


De Tamble chassis and runabout.



Pennsylvania motor and cylinders cast en bloc

McFarlan exhibit, showing six-cylinder touring car.



Clark-Norwalk exhibit, showing Clark and Norwalk chassis

Co. is new, there being three additions. There are two chassis which are shown for the first time, the cylinders of the motor being cast singly and bolted together, giving an en bloc effect. The Petrel is one of the few examples at the show of friction control and the company has added three new chassis, which gives it a wide range—one 3 3-4 by 4 1-2; two others at 4 3-8 by 4 3-4 and a fourth at 4 3-8 by 5 1-4. The body styles give a wide range of choice and altogether the display is a most creditable one.

The Washington of the Carter Motor Car Corporation of Washington, D. C., has a motor of 4 1-8 by 5 1-4 with the cylinders cast in pairs and with the valves all on one side. There is a gear-driven water pump and a self-contained oiling system operated by a gear-driven pump. The clutch is a multiple-disk and the wheelbase 118 inches. The body styles include a two-passenger roadster, a baby tonneau of the torpedo type and a touring car with double Dutch doors.

The Lexington is no stranger to the motoring world and at the present show the car is being exhibited by its New York agent. The Lexington 40 has a Rutenber motor of the Renault type, with a 4 1-2-inch bore and 5-inch stroke, with the cylinders separately cast and mounted on an aluminum frame, the top part of which supports the entire motor, while the lower part may be removed, giving access to the crankcase. The body styles include a roadster with a torpedo body and a touring car.

The Metz line includes three runabouts and a chassis of the regular type made by that company.

The Velie display is one of the largest in the show, including a racy roadster, fore-door touring cars and closed bodies.

The Houpt-Rockwell concern is represented by a taxicab, landaulet and touring car.

The L. J. Bergdoll Company, of Philadelphia, has a large exhibit of styles and bodies on the one chassis made by the company.

The Warren-Detroit shows six types embracing everything from a runabout and an improved torpedo, fore-door roadster to its big touring car.

The Gaylord exhibits a car that combines the features of a touring car and parcel carrier, called a utility body.

The Alpena Flyer is represented by two popular models.

The Krit shows a line of four complete cars and chassis.

The Arbenz, made by the Scioto Auto Co., has a single model of a touring car on show.

The Henry is represented by a full line of attractive looking cars, the feature of the display being a fore-door roadster of graceful lines.

The Abbott-Detroit line is particularly attractive, the car exhibit being grouped around a stylish-looking coupé, fitted up in the utmost luxury.

The Firestone-Columbus cars are shown in two models of touring cars.

The Imperial line, including five cars, makes an excellent show in the main exhibition hall.

The Penn Unit, made by the Penn Unit Car Co., of Allentown, Pa., makes its bow, and there is a great variety of body styles designed for light delivery purposes. Among the features cited are a quick-demountable unit power plant, three-point suspension, selective sliding gearset, Hele-Shaw clutch, straight line drive, left side control, two sets of internal expanding brakes on the rear wheels, etc.

The exhibit of the International Harvester Co., consisting of a panel wagon and an open body, demonstrated by a chassis, is attracting much attention among the light delivery displays. The cars are businesslike in appearance and the body is easily interchangeable into a pleasure car.

New in the Hart-Kraft line are models C and D, the former of 3,000-pound capacity and the latter of 5,000-pound. Both have four-cylinder motors 4 1-4 by 4 3-4, C having 120-inch wheelbase and D 140. The Hele-Shaw clutch is used and the Evans transmission.

The American Motor Truck Co., of Lockport, N. Y., in business for six years, has three chassis of varying capacity—two 3 1-2 and 5-ton. Besides this it has a 3 1-2-ton electric.

This is the first show for the Cortland Motor Wagon Co., of Cortland, N. Y., and it is improving the opportunity to show a chassis with a 16-horsepower, two-cylinder, four-cycle motor with a 4 1-4-inch bore and stroke. There are five body styles in light delivery rigs and station buses.

The Atterbury Motor Car Co., of Buffalo, gives the business world a wide range in choice in five chassis, which include a K 20, a four-cylinder 1,500-pound delivery wagon; L 30, a four-cylinder 1 1-2-ton; N 40, a 2-ton; M 50, a 3-ton, and O 60, a 5-ton. Changes in the line take in the substitution of a Hele-Shaw for a cone clutch, a folding starting crank of merit, while on the N, M and O there is a special channel steel frame, wood being used on the other two.

The Crown Commercial Car Co., of Milwaukee, showing through its New York agent, has a light delivery proposition which comes in five models and which is of 1000-1500-pound capacity. As is usual the purchaser is given a wide range of choice in body styles.

The Johnson Service Co. of Milwaukee has a second string to its bow in the way of a commercial display of wide range. There are three motors just the same as in the pleasure car line.

The Monitor is a 1-ton delivery wagon which is shown by the New York agent and the car shows several changes. The motor has been increased in power from 18 to 24 and provided with a governor set at 1,100 revolutions per minute.

The Geneva Wagon Company, of Geneva, N. Y., is a newcomer and presents one chassis which will carry panel top delivery and express wagons, ambulances and wagonettes. Accessibility is the keynote and the engine is mounted in front below the frame and bonneted.

A newcomer, the Oliver Motor Car Company, of Detroit, makes a strong feature of its removable power plant. The engine and transmission are assembled as one unit. To the front of the engine crankcase is bolted the supporting cross member, which has brackets for carrying the radiator and starting crank. The power plant may be removed by taking out a bolt at each end of the engine-supporting cross member and two nuts from the strap on the transmission case, which rests on the frame cross member, and disconnecting the gasoline pipe and foot pedals.

The New Haven Truck & Auto Company goes in for big trucks only and has a five-ton truck which is called the Moeller. This is its first show. The engine is a four-cylinder Rutenber with the 4 1-2 by 5-inch cylinders cast singly.

Spring suspension is one of the strong features of the product of the Martin Carriage Works, of York, Pa., its special design enabling, it is claimed, the four wheels getting the same traction despite the condition of the roads. Transverse platform springs are fitted in the rear and again in the middle of the body, being attached in the center by what might be called pivot one-point suspension.

A talking point with the Beyster-Detroit, light delivery, is the electric lighting system which does away with oil lamps, there even being an incandescent to illuminate the interior of the panel bodies. The Beyster carries a 20-horsepower four-cylinder, has planetary gears, thermo-syphon cooling and side chain drive. The wheels are 36-inch solids.

Showing for the first time, the American Motor Truck Company, of Detroit, employs four-wheel drive and double steering in its one, two, three, five and ten-ton trucks. On the one and two-ton trucks the motor is a two-cylinder four-cycle with 5 and 5 1-2-inch motors respectively. The three-ton carries a four-cylinder 4 1-2 by 4, the five-ton a four with 5 1-2 square, while it takes a four-cylinder 6 1-2 by 6 to operate the ten- ton. The gearset is planetary and there is single-chain drive to both front and rear axles.

As usual, the Gramm Motor Car Company, of Lima, Ohio, has a comprehensive display, its trucks being built of one, two, three and five-ton capacity. The one-ton has a four-cylinder en bloc motor of 4 by 5, the power plant being a unit system and the oiler

self-contained in the motor. The clutch is a multiple disk and the cooling is thermo-syphon. Drive is by chain and the weight is about 2,800 pounds. The wheels are 34 by 3 1-2. The motor on the two-ton truck also is a four, but the cylinders are cast in pairs and have a bore and stroke of 4 1-4 by 4 1-2 inches, the mechanically-operated valves being on one side. A gear-driven pump is found in the cooling system and the gearset is selective sliding. The clutch is a multiple-disk and the wheelbase 124 inches. The three-ton motor has a bore of 5 by 5, a wheelbase of 124 inches and a tread of 66. This same motor is used on the five-ton trucks and in general details it is about the same. The wheelbase, however, is 130 inches and the tread 69.

The Findlay Motor Company, of Findlay, Ohio, makes the Ewing, and a neat idea on a light delivery car is the placing of the cylindrical gasoline tank back of the driver's seat and ahead of the loading space. This wagon has a capacity of from 500 to 750 pounds, uses shaft drive and has a wheelbase of 84 inches. There are 30-inch wheels fitted with pneumatics. The engine is a two-cylinder of 4 3-8 by 4 3-4 bore and stroke, using pump water circulation and selective gearset. The model A is larger, having a 1,000-pound load capacity. It uses a four-cylinder motor with 4 3-8-inch bore and 4 3-4-inch stroke, the motor being located in front.

The Chase Motor Truck Company, of Syracuse, N. Y., has a new model of the surrey type as well as a model K 2,000-pound wagon which uses a sliding gearset and a 4,000-pound machine. Another 2,000-pound wagon has a planetary gearset. Old models retained include the D, which has been made heavier, fitted with larger axles, heavier springs, a magneto and given more efficient brakes. The Chase continues its two-cycle three-cylinder valveless motor, which is air-cooled, the cooling being assisted by a turbine fan which is cast integral with the flywheel. The lubrication is effected by mixing one quart of heavy engine oil to each five gallons of gasoline, the mixture passing through the carbureter and being carried in the cylinders along with the gasoline vapor.

Seitz trucks and delivery wagons, made by the Seitz Automobile & Transmission Company, of Detroit, comprise five different chassis in sizes one-half, one, two, three and five-ton, to which almost any style of body may be fitted. The feature is the Seitz double friction transmission.

The Victor, made by the Victor Motor Truck Company, of Buffalo, has a line which includes 1 1-2, 2 1-2, 3 1-2 and 5-ton models, while among the body styles are sightseeing buses and even a ladder truck for fire department use. Four-cylinder motors are used through the line, but are of varying sizes.

The Saurer is the one foreign truck in the show. The Swiss uses a four-cylinder, four-cycle, water-cooled engine with the inlets and exhausts operated by camshafts placed on opposite sides of the engine, the crankshaft, fanshaft and camshafts being ball-bearinged.

The Cass truck is shown in a single model, a businesslike car that is highly recommended by its makers for service and dependability.

The Chicago Pneumatic Tool Company shows four trucks of various sizes, from a paneled wagon to express trucks.

The Coleman Carriage & Harness Company, of Ilion, N. Y., shows a serviceable looking truck of 20-horsepower.

While the list of accessory exhibitors is small, the number of the devices shown are interesting and useful.

Among the displays are the following:

The American Pedal Company, of New York, is showing a line of pedal grips under the trade name of "Apco." The particular feature of this device is the corrugated rubber treads to prevent the foot of the operator from slipping in ordinary driving, and also in case of emergency.

Nat Finkelstein is showing a combination tool, combining the uses of hammer, wrench, riveting mallet, tire-iron and half a dozen others, called the "Rex"; the Dixie horn, which is attached to the exhaust and is simple mechanically, and "Clearview," a fluid for clearing and cleaning glass and preventing the deposit of moisture upon it. The line is handled by the Perfection Tool and Accessory Company, of New York.

The Bushey Demountable Rim Company is showing a full line of its products. The operation of this device is simple; one-quarter turn of the cam increases the circumference of the wheel and expands it against the rim so that it is held very firmly in applying the rim.

The Safety Tire Company, of New York, is showing a tire with submerged studs that is said to obviate the necessity for non-skid chains. The tread is raised and the studs, which are hollow tubes, are arranged to pick up earth or grit, to give an earth-to-earth contact.

A curtain fastener, manufactured by the Ross Heaton Manufacturing Company, of Emporia, Va., is one of the brand-new things displayed at the show. The fastener is oval in form and has been tested to a pressure of ten times the ordinary strain.

The Sharp Spark Plug Company, of Wellington, Ohio, is showing a line of plugs. They are guaranteed by their makers not to carbonize or miss fire.

The New Process Vulcanizer Company, of Toledo, Ohio, has a vulcanizing outfit on show, for which they claim many excellencies. The device is a compact, portable arrangement for tire repair, heated by wood alcohol.

The Bristol Company, of Waterbury, Conn., exhibits a line of gauges for recording pressures ranging all the way from those of running water and the tides to steam boilers and recorders for taxicabs.

A. H. Green & Co. show the "Brandt" blow torch, the dynamo "La Magicienne" and "Salom" batteries for automobile lighting.

William R. Winn displays a line of lubricating oils and greases. The "Runeasy" line includes cylinder oils, automobile heavy and light greases and various affiliated substances.

A. J. Myers, Inc., showing the G. & A. carbureters for automobiles and aeroplanes, has an attractive booth. Sectional carbureters and complete instruments are on display.

The Standard Metal Work Company is showing manifolds of various kinds suitable for gas engines. The feature of the exhibit is the "Div-Plug," a patented cylinder connection.

The John W. Rapp Company exhibits its line of all-metal automobile bodies.

"Fabrikoid," a cloth used in top-making, is shown in one end of the main accessory hall.

Duntley electric portable tools are shown by the Chicago Pneumatic Tool Company.

The Vertical Dividable Windshield is shown in the balcony by the Auto Necessities Company, of New York.

The Economy Tread Company exhibits its tread and tire protector. The tread is made of chrome tire leather, studded with flat-top rivets of steel. It is adjusted by clamp to clincher.

The Beheringer radiator, built in light sections that are removable with ease, is a feature of the main accessory hall. The sections are composed of strips as long as the radiator, held in place by joints at the top.

The "Ideal" auto wind deflector, a non-glass shield; the Gregory spark metal gas igniter, to obviate the use of matches; the Buffington folding steel chairs and stools, for extra seats in automobiles; the Ball multi-spark plug, made in Minneapolis; the B. & E. line of specialties, including demountable rim covers, non-skid sectional devices, dome lights, windshields and lamp covers, occupy prominent spaces.

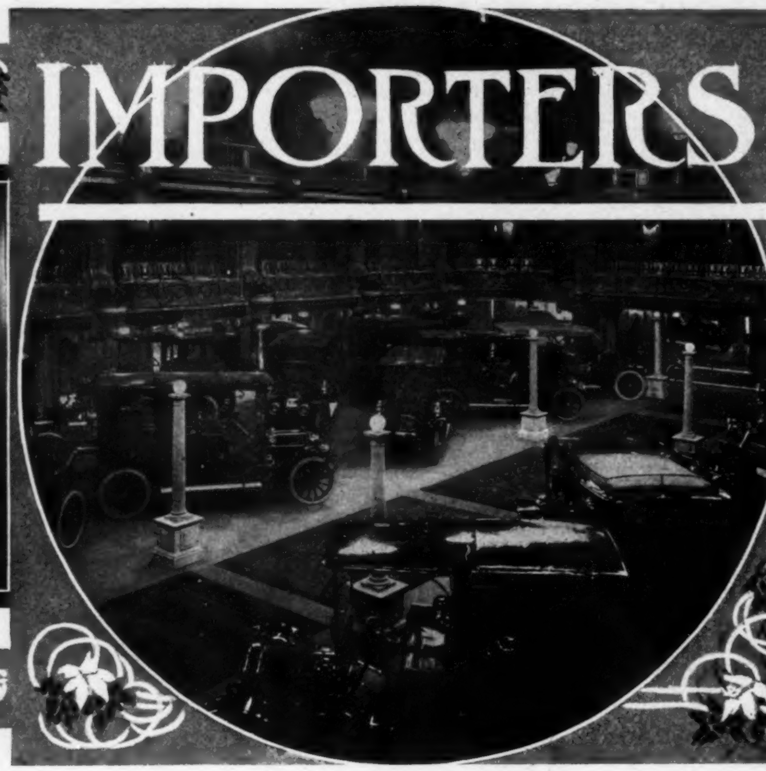
A. H. Kasner, exhibiting the Anchor tires in much detail, has a busy stand.

Among the aeroplane accessory exhibits are the following:

The Requa Gibson propellers, shown by E. W. Bonson & Co.; the McAdamite Metal Company, displaying a line of parts, the base of which is aluminum to replace brass and bronze; the Hall-Scott motor, used by Hamilton and others; the D and F radiator, which is used for automobiles as well as aeroplanes; E. J. Willis, a full line of aeroplane supplies; Fox De Luxe motor; the New York *World's* exhibit; the Anzani motor, and various publications devoted to flying.

IMPORTERS

SIX-CYLINDER RENAULT WITH CABRIOLET BODY



BANQUETING HALL FROM THE 44TH STREET SIDE

THE banqueting hall of the Hotel Astor is the venue chosen this year for the Importers' Automobile Salon. The space is somewhat limited, but as there are but fifteen different makes of cars shown, the hall, with its two wings, does not seem to be overcrowded. The surroundings certainly add to the finish of the body work and the visitor loses sight of the usual field of commercialism amidst the gilded halls. The limousine is the standard of body design in one form or another. Where a touring car is shown it is usually of the torpedo type. On entering the hotel by the main Broadway entrance, the visitor sees two polished chassis, one a De Dion four-cylinder on the left, specially designed for American roads, and a 25-35 Renault on the right. The De Dion Bouton chassis has one or two departures from usual De Dion practice, such as air-cooled foot brake and self-supporting rear axle instead of the sub-axle type. The center of gravity is high and the rear springs, which are of the 3-4 elliptic type, are very long.

Passing into the side wing of the main hall there is seen the Metallurgique exhibit, consisting of a special limousine by Van Den Plas. Both chassis and body are manufactured in Belgium. A feature of this car is the inside fittings, which are all made from selected woods with the exception of the seats, which are upholstered and trimmed with lace cushions. A dome is fitted in the roof as well as two extra armchair seats in Louis XIV style. The chassis is fitted with a 40-horsepower motor of the L type, Bosch high-tension magneto and Zenith carbureter. The wheelbase is 144 inches and there are twin tires on the rear wheels fitted to Vinet rims. This car is new to America, and Warwick Wright, the managing director of the English agency, which takes the entire production from the Belgian works, has come over to introduce the car. A characteristic feature of all Metallurgique cars is a V-nosed radiator sometimes seen on racing cars.

Next is the S. P. A., also a newcomer. The chassis is made in Turin, Italy, and is on the lines of other Italian cars. It was designed by M. Ceirano, who, for several years, was the designer of the Itala cars. Two cars are shown, a two-seated raceabout with large gasoline tank and holder for four tires on the rear and a 20-horsepower landaulet. The motor of the 15-20-horsepower is of the monobloc type, with the valves on one side, high-tension magneto ignition and forced feed lubrication. The clutch is of the multiple-disc type and the transmission is selective, with four speeds and reverse. The final drive is by live axle. The agents for New England for these cars are A. C. Morse & Co., Park Square, Boston, Mass.

The Darracq exhibit consists of a six-cylinder touring car fitted for seven passengers and a 24-horsepower landaulet painted green and upholstered in French cord.

The Peugeot Import Co. has a four-cylinder model fitted with a landaulet that had to be finished in a hurry to enable it to be at the exhibition, which does not give the body builder any opportunity for fine finish. The car is of French origin and was one of the pioneers in the early nineties. It is fitted with high-tension ignition and Claudel carbureter, selective transmission giving four speeds and reverse and the final drive by live axle. Special design spring drive hubs are fitted and the brakes are operated by pedal and hand lever, the lever working the brakes on the propeller shaft and the pedal on the rear wheel hubs.

On entering the banquet hall, on the left is the C. G. V. and Zedel exhibit, consisting of a limousine by Kellner, of Paris, on a six-cylinder chassis and low-built, close-coupled touring car tastefully painted in gray, with red lines. There are also a town landaulet with body work by Demarest and a four-cylinder 16-20 coupé to accommodate three passengers inside. All the C. G. V. cars have left-hand steering, with central control for the gear and brake levers. The radiator is placed behind the motor, forming the dash, and the piping of the thermo-syphon cooling is ample in size. The Zedel is a French car also, being made in the south of France. Although not installed at this writing, the car to be shown is an inside drive collapsible landaulet fitted to a 12-horsepower chassis. The motor has a bore of 72 mm. and a stroke of 120 mm., and unlike most cars of this power, is fitted with four speeds. The motor is of the bloc type.

The Panhard & Levassor agency is showing one of the Panhard Knight engines of 30 horsepower, fitted to a standard Panhard chassis, as well as a special limousine by M. Labourdette, of Paris, that figured at the Paris Salon. It is built to carry seven passengers, upholstered in drab cord cloth and has

BANQUETING HALL FROM THE 45TH STREET SIDE

METALLURGIQUE WITH VAN DEN PLAS LIMOUSINE

two reversible seats that can be made to face forward or vis-a-vis. Besides this there are a six-cylinder 35-horsepower chassis fitted with a limousine, a town landaulet on a Knight Panhard chassis and a town landaulet with body work by Holbrook.

The De Dion exhibit is the last on the left-hand side of the hall and consists of five models. A polished chassis is shown similar to the one at the entrance, only of lower power. An eight-cylinder torpedo of clean-cut design, painted light fawn, has the gasoline tank situated under the cowl of the sloping dash. A neat town landaulet by Burr & Co. and a limousine are also shown.

The S. P. O. Automobile Company exhibits a two-seated S. P. C. car of the raceabout type and a Vinot Deguinand. Both of these cars are manufactured in France. The miniature limousine fitted to the Vinot is after the style of an old-time coach with small square windows and oval top.

Quinby & Co., of Newark, N. J., have three models of the Italian Isotta cars fitted with their bodywork, a toy tonneau, a D-fronted limousine and a five-passenger touring limousine. Besides these there is a fore-door type of limousine without chassis, with the bare aluminum panel—a Quinby specialty.

The Napier exhibit consists of a six-cylinder chassis fitted with detachable wire wheels and an example of English bodywork by Mullin, of London, being a light green landaulet with uncommon lines.

The Benz exhibit is large and the center of attraction. It consists of the No. 15 Benz with which Bruce-Brown won the Grand Prize recently at Savannah; a neat 30-horsepower Sports-Wagen and a roomy 50-horsepower torpedo painted white and upholstered in light pigskin, besides which there are several limousines and landaulets ranging from 18 to 50 horsepower.

A. T. Demarest & Co. are showing Itala, Renault and English Daimler cars; the latter, however, had not arrived at the opening of the show. The Itala exhibit consists of a 16-20 chassis, a town landaulet painted dark blue, with white lines, on a 16-horsepower chassis, and a 20-30 limousine. There are also three Renault chassis with Demarest bodywork, including a D-fronted town car painted red and with plenty of room inside. At the end of the right aisle is the Renault exhibit, in which there are two novelties in body design. A 25-35 long chassis is fitted with a Berline body; it is a large fore-door limousine to accommodate six passengers inside and was built by Moore & Monger. There is an icebox for provisions, a wash basin, writing cabinet and extra wood shield to take the place of the ordinary glass windows. The front windows can be lowered and mosquito netting frames can be drawn up instead, giving plenty of air but excluding flies and dust. The top is raised into a dome with side lights and the fittings, with the exception of the seats, are finished in Circassian walnut. The front compartment is entirely enclosed, with a small leather hood over the top of the windshield, and although the car is very large it has a good appearance. The 50-60 cabriolet is a distinctive creation and can be turned from an entirely closed car to an open car in a few minutes. It is painted French gray and trimmed in light pigskin. The balance of the exhibit consists of three 25-35 American special chassis fitted with limousine and landaulet bodies and a 10-12 1911 chassis with underslung rear springs, this being a departure from usual Renault practice. The musical program is good, and the soft tones of the organ in keeping with the surroundings.

Prior to the opening a lunch was given in the hotel to the press and after an able speech by Mons. LaCroix several representatives of the press were called upon to speak.

All Vehicles to Carry Lights

WASHINGTON, D. C., Jan. 2—Universal lights are now the order of the day in the capital of the United States. Beginning yesterday, the regulation requiring lights on all horse vehicles will be strictly enforced. The regulation provides that every private vehicle between one-half hour after sunset and 1 A. M. shall display a white light, visible for a distance of at least 200 feet from the front, sides and rear. The regulation will not apply to vehicles belated by accident not more than one and one-half hours after sunset and en route to their stables at a pace not faster than a walk.

The regulations will be tested in the courts, a decision to this effect having been made by the Team Owners' Association.

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THERE seem to be upward of 440,000 automobiles in actual use at the present time, and considering the fact that there was but one automobile registered in the State of New York on January 1, 1901, it is a pretty good showing for an infant industry. It will not now be possible to fix the original price of the one automobile referred to, but it may readily be indicated that the prices of automobiles have not fallen off in response to the prediction of those who make a practice of such things. An examination into this price question has resulted in a series of averages, and in 1903 the average price for all the automobiles made was $1,133.37. For 1904 the price increased to $1,341.45, and in the following year there was a drop to a little over $1,000. It was during this slump period that predictors were busy discussing the merits of the coming $200 automobile. In the meantime prices advanced, reaching a maximum of $2,137.56 in 1907, and the averages gradually receded from that day to this, dropping to an average of $1,645.93 for 1910, which is a very good price, considering the fact that the product of the year was approximately 188,000 automobiles of the passenger type alone.

* * *

THOSE who gather the impression that there are too many automobiles being made probably overlook the fact that of the 440,000 cars now actually running, over 200,000 of them are in commission in six States. It is impossible to argue that the people of six of these United States are the possessors of 50 per cent. of all of the intelligence. It would be reasonable to expect that the States like New York, Ohio, New Jersey, Pennsylvania, Illinois, and Massachusetts, with their relatively big metropolitan districts, would have a disproportionately large percentage of the total number of automobiles built during the first ten years of the history of the industry, but there is nothing to prevent the people in the remaining centers from indulging in automobiles whenever they see fit, and that they will see their way clear to take advantage of proven modes of transportation is self-evident. As a matter of fact, the sale of automobiles during the last year increased marvelously in the States outside of the six before mentioned, and this process of equalization, which has really just started, constitutes the best promise that the automobile industry has for the coming year, and is the proper ground for contending that the demand for cars is positively on the increase, with small chance of reaching the peak of the wave for a twelvemonth.

* * *

PUBLIC interest in the automobile has never slackened, and the men who do not take an interest in things mechanical in general spend a vast amount of time poring over mechanisms of cars, trying to appreciate the differences between them, and to reach conclusions bearing upon the efficacy of the respective plans. In the past it has not been difficult to trace the trend and the ramifications; changes were wrought with terrific speed, and they were so material and spectacular that no great skill was required in ferreting them out. Those who may have occasion to visit the Garden this year have probably found in their experience at the Palace that it is no longer possible to discern the differences between the models of a year ago and those of to-day, excepting that body work has advanced to the fore-door type almost universally. But the changes are there, and, strange to relate, they are of a more pronounced character that those of former years. The real struggle is with the materials of which parts are made, and in connection with the thermic relations of the motor and a higher degree of mechanical efficiency of the transmission systems. The thermal efficiency of motors has advanced fully 10 per cent. in the scale this year, which is really a 50 per cent. gain in fuel economy. The mechanical efficiency of transmission systems has also gone up at least 10 per cent. These gains merely indicate that designers are active and that the laboratory is now in control, banishing rule-of-thumb methods from the automobile forever.

TURNING over a new leaf is not a bad practice for those who desire to progress, and the few spots in the automobile industry which do not seem to be ornaments are due to the fact that after designers get through with their part of the work purchasing agents sometimes find that there is a famine of drop-forgings, and they forthwith order the parts duplicated in bronze or brass. It is obviously a wrong thing to do unless it can be shown that these castings, which may be had at any time, are better than drop-forgings of steel. It is highly improbable that the castings will prove to be better; moreover, they would be included in the original design in that event.

Standardization Keynote of S. A. E. Meeting

AS outlined in THE AUTOMOBILE recently, the program of the coming convention of the Society of Automobile Engineers will be both varied and interesting to the manufacturing trade.

The official program of the seven sessions to be held in the assembly hall of the Automobile Club of America is as follows:

WEDNESDAY, JANUARY 11

9 a. m.—Business Session.—Opening Address by the President, H. E. Coffin; Report of Tellers of Election of Members; Treasurer's Report; Annual Report of the Council; Report of Tellers of Election of Officers; Discussion of Proposed Amendments to the Society's Constitution.

2 p. m.—Professional Session.—Electro Steel, paper by Joseph Schaeffers; Illustrations of Physical Facts Relating to Metallurgy, address by Radclyffe Furness; Reports of Standards Committee—Introduction by Henry Souther, Chairman; Iron and Steel Division, M. T. Lothrop; Aluminum and Copper Alloys Division, Wm. H. Barr; Ball and Roller Bearings Division, D. F. Graham; Broaches Division, C. E. Davis; Gear Metal Constants Division, G. W. Sargent; Carbureter Division, G. G. Behn; Frame Sections Division, James H. Foster. Lock Washers Division, Frederick S. Sayre. Nomenclature Division, A. L. McMurtry. Seamless Steel Tubes Division, H. W. Alden. Sheet Metals Division, H. E. Coffin. Springs Division, A. C. Bergmann. Tire Efficiency Division, F. J. Newman. Miscellaneous Division, Henry Souther. Influence of Multi-point Ignition on Output and Efficiency of the Internal Combustion Engine. Demonstration by Otto Heins on the Dynamometer of the Automobile Club of America.

6.30 p. m.—Reception.—Address by the Retiring President and the President-Elect.

7 p. m.—Society Dinner, followed by Entertainment Arranged by Local Committee.

THURSDAY, JANUARY 12

9 a. m.—Professional Session.—The Construction of Highways for Motor Traffic, address by Logan Waller Page, United States Director of Good Roads, Department of Agriculture. Leaf Springs, Design and Methods of Mounting and of Treatment by the Manufacturer and the User, Paper by E. K. Rowland. Topic for Discussion, Shock Absorbers. Novelties in Valve Systems, Paper by E. P. Batzell. Hot Rolled Gears, Paper by H. N. Anderson. Commercial Gasoline and the Impurities That Are Being Encountered, Paper by F. H. Floyd.

2 p. m.—Professional Session.—The Test of a 20-horsepower Franklin Air-cooled Motor, Conclusion of paper by L. R. Evans and R. P. Lay, introduction by Prof. R. C. Carpenter (postponed from the last meeting of the Society). Development of the Grinding Wheel, Paper by George N. Jeppson. Methods of Grinding, Paper by John C. Spence. "Frictionless" Friction Drive, paper by Charles E. Duryea. The Fire Protection Question, paper by N. B. Pope. Contest Rules That Affect the Engineer, address by A. L. McMurtry, Chairman of Technical Committee of American Automobile Association. Topic for Discussion, The Engineering Lessons of the Motor Car Contest. Automobile Contest Timing and Coaching. Paper by Chester S. Ricker.

8 p. m.—PROFESSIONAL SESSION—(COMMERCIAL VEHICLES)—*Papers*—Report of Standards Committee Division on Wood Wheel Dimensions and Fastenings for Solid Tires, Standardization Possibilities in the Commercial Car Field. W. P. Kennedy. Advantages of Long-Stroke Motors, paper by E. A. Myers. Foolproofing the Commercial Car Mechanism and Its Control, paper by A. J. Slade. Co-operation between the Electric Vehicle Manufacturer and the Central Station, address by Robt. McA. Lloyd. The Ampere-hour Meter for Electric Vehicles, paper by R. C. Lanphier. *Topics for Discussion*—Vertical Motors under Footboards versus Vertical Motors under Hood, introduction by B. D. Gray. Proper Power and Speed of Gasoline Motors for Truck Purposes, and Proper Road Speeds for Vehicles of Different Capacities. Introduction by P. H. Breed. Chain Drive for Trucks and the Necessity of Housing Same. Type of Transmission for Trucks. Gasoline-Electric Transmissions for Heavy Loads. Introduction by Alex. Churchward. Tire Mileage and Costs. Multiple Uses for Machines for Municipal Service.

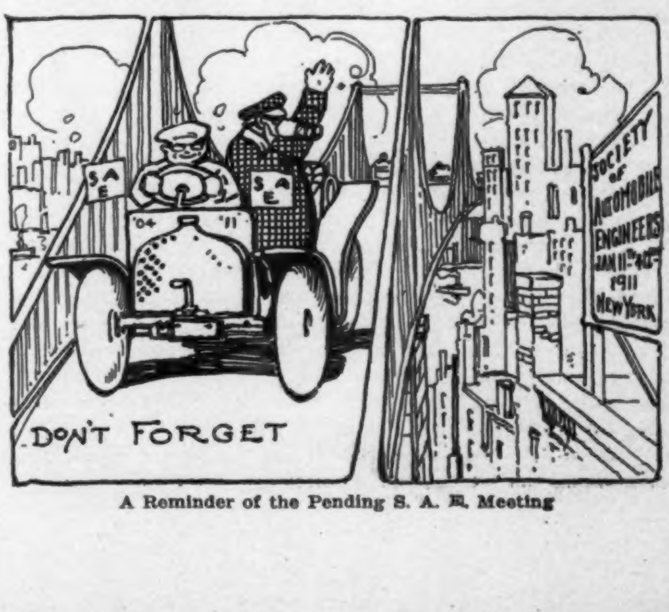
Additional Subjects—For Discussion if the Opportunity Affords.—Drive-Shaft versus Rear Wheel Brakes; Multiple-Disc Clutches; Three-Point versus Four-Point Suspension; Current Practices in Lubrication and Practical Results Obtained; Smoky Exhausts; Wheel Alignment, Camber and Foregather; Valve-Seat Angles; Cast-Iron Valves; T-Head versus L-Head versus Valve-in-the-Head Construction; Piston Ring Fitting and Piston Ring Friction; Proportioning Cooling Systems; Elimination of Noise in Motor Cars; Brake Materials and Surfaces; Six-Cylinder versus Four-Cylinder Motors of Equal Rating; Worm Drive; Lighting an Automobile; Steering Gears; Tire Inflation.

New Independent Organization of Makers

The A. M. C. M. E. A., which is now exploiting the Palace show, does not share profits with the makers of the automobiles that are being exhibited there, and, on account of the complication involved, it is difficult, if not impossible, for the makers who exhibited at the Palace to get a sanction to exhibit at the Chicago show. The N. A. A. M. has always favored associations of automobile manufacturers on a profit-sharing basis, and it is believed by those who are now exhibiting at the Palace that it will be better to form an organization somewhat akin to the old A. M. C. M. A., of which Alfred Reeves was the able general manager.

The new organization, if it is consummated, will be known as the United States Motor Vehicle Manufacturers' Association. As the story goes, the 1912 show will be under the auspices of this new organization.

With this idea in mind a call has been issued for a meeting to be held next Thursday at the Manhattan to form the United States Motor Vehicle Manufacturers' Association. The call is signed by Thomas Aldcorn, of the Chicago Pneumatic Tool Company, makers of motor trucks at Franklin, Pa.; Carl F. Johnson, of the Johnson Service Company, of Milwaukee, and C. W. Kelsey, of the C. W. Kelsey Manufacturing Company, of Hartford, Conn. Frank Harvey Field is counsel for the proposed organization. The initiation fee is set at $250, with annual dues of the same amount.



A Reminder of the Pending S. A. E. Meeting

A. L. A. M. Show and the Vogue of the Motor

REPRESENTING the concrete effort of many hands and brains, the A. L. A. M. show, which opens Saturday evening at Madison Square Garden is hailed as the most complete exhibition of the motor car ever held in this country and probably in the world. Preparations are about complete—nothing remains to be done but give the big building a careful cleaning and to install the exhibits.

The preliminaries of the show have been outlined with much emphasis in The Automobile during the past three months and now comes the realization. Among those who have been particularly active in working for the success of the show are the writers whose articles appear herewith, covering a field as wide as motordom. The articles are as follows:

Motor Car Now Tool of Civilization

BY ALFRED REEVES, GENERAL MANAGER A. L. A. M.

Making strides of a gigantic nature, the motor car, since the first automobile show in Madison Square Garden, New York, eleven years ago, has traveled from a place where it was the toy of the rich and a vehicle for pleasure use only to its present enviable position in our industrial life, where it can truthfully be called a tool of civilization. Instead of motoring being considered a fad, it is now a necessity, like any other means of transportation, and its position as a time-saver answers fully any question as to its future.

It has performed in most loyal fashion ever since it came into general use, and certainly no other invention of which we have record has traveled the pace which marks the advance of the motor car during the past ten or eleven years. To appreciate the progress which has brought the gasoline-fed vehicle to its present high position, one has but to consider the short time since motor cars were regarded as experiments and curiosities, for such was their status when the first automobile show was held in Madison Square Garden eleven years ago.

Each year has seen progress of an extraordinary sort, until we have the perfect car of to-day, the very latest models of which will be shown at the big National Automobile Show which opens at Madison Square Garden on January 7 and continues for two weeks; the double show being necessitated by the large number of makers now licensed under the Selden Patent.

With almost 400,000 machines in use in this country, and the number fast increasing, the statement that the automobile is now the tool of civilization admits of little argument. The so-called pleasure car or passenger carrying vehicle is, to a large degree, an absolute necessity to a great number of our American people, not one of whom would think of giving up his car any more than he would consider dispensing with his telephone, after its advantages were appreciated. In addition there are thousands of new owners entering the field every month, all of whom are receiving proof of an indisputable character in favor of the motor car's advantages.

Cars are now so generally used, and the conveniences and time-saving qualities so strongly in evidence in our everyday life, that machines are not alone taking the place of the horse, but are opening up new fields in our lives that would be undreamed of under ordinary conditions. As a health giver, and as an educational factor, the motor is far more important than as a mere vehicle for pleasure driving. Every family can find almost continuous use for the modern motor vehicle. The head of the house can use it going to and from his business; for making calls; entertaining customers and business associates, and for touring. This use of the car gives him a greater knowledge of the country, while the mental and physical exercise of driving makes for better digestion and better health. The ownership of a car certainly adds prestige.

A man's wife and daughters may use the car for social calls, entertaining and for open-air driving.

On behalf of the sons, it must be admitted that caring for and understanding a great piece of machinery like the motor car has an educational value, while the mental and physical faculties in man are developed by driving. The fresh air recreation cannot but improve his health, and using the car gives the sons more time with the other members of the family, and therefore brings him under the best influence.

As a willing slave for all work, the motor vehicle is now entering that broad commercial field involving the transportation of freight, and the quicker and more economical distribution of merchandise, which foretells the emancipation of the horse, and will tend to bring close to hand the time when that noble animal will become the pet of mankind, instead of the slave of a cruel business life. It would be absurd to say that the horse will be relegated quickly, for with 31,000,000 horses in the country, and some 7,000,000 horse-drawn vehicles, the displacement proposition will be of a steady but not abnormal growth. Nevertheless, the ultimate outcome must see traffic, especially in our large cities where it is of a congested nature, given over entirely to power-driven machines. It is not too optimistic to say that ten years from now, a horse on the streets of New York will be as rare as a motor vehicle was ten years ago.

History of the Garden Automobile Shows

BY COLONEL GEORGE POPE, CHAIRMAN SHOW COMMITTEE, A. L. A. M.

It is a far cry from the crude, shapeless, intolerably noisy, balky, almost useless mass of complicated machinery on wheels—in other words, the automobile of a decade and a half ago—to the more luxurious, efficient, powerful and speedy motor car of to-day. This is an age of rapid progress and people are becoming accustomed to wonderful development in phenomenally short periods of time, but perhaps the most remarkable example of rapid development is exemplified in the automobile. In no manner can this development be observed as readily as through the automobile shows held in this country.

Although the automobile show period began as far back as 1898, the first real automobile show did not take place until two years later. A few automobiles were shown in the same exhibitions with bicycles both in New York and Chicago shows in 1898 and 1899. The first real show was held in Madison Square Garden during the week of November 3-10, 1900.

At this first show there were 31 exhibitors of complete motor cars and 20 concerns showing parts and accessories, but there were not a sufficient number to fill the large area of floor space in Madison Square Garden and so a flat oval track for showing the cars in motion was built in the Garden and on the roof was erected on incline designed to show the hill-climbing capabilities of the machines. Persons who wished to cross from the enclosure to the booths on the outside of the track were transported over a bridge spanning the track.

It is rather amusing at this day to contemplate the exhibits that marked the first automobile show in 1900. Steam-propelled vehicles were easily in predominance, with a goodly number of electrics, while gasoline machines showed a bad third, in striking contradistinction to the order of to-day.

The second national show was held in the Garden during the week of November 2-9, 1901. As striking evidence of the growth of the automobile industry in one year is cited the fact that at the second show there were 93 exhibitors as compared with a total of 51 exhibitors at the first show. At the second show the track was omitted.

The National Association of Automobile Manufacturers was then organized and after several conferences it was decided to hold the next show at the beginning of the following year. The date was January 17-24, 1903, and more than 150 exhibitors were represented.

The fourth national automobile show was held at Madison

Square Garden January 16-23, 1904. One hundred and eighty-five exhibitors were represented this time. A year later the industry had grown to such an extent that many companies applying for space had to be refused. The fifth show was held January 14-21, 1905, and 250 exhibitors had space.

After the 1905 show, the Association of Licensed Automobile Manufacturers secured control of the expired contract that had existed with the Madison Square Garden Co.

The first show under auspices and management of the A. L. A. M. and the sixth to be held in the Garden took place the week of January 13-20, 1906, and at which 50 exhibitors of cars and 170 manufacturers of parts and sundries were represented.

Under the same auspices as its predecessor, the seventh annual show was held in the Garden during the week of Jan. 12-19, 1907. More than 7000 people attended the opening. The number of makers who showed cars was 42 and there were 202 accessories exhibits.

The eighth national show was held at the same place November 3-10, 1907. There were 68 exhibits of complete cars, a number of commercial vehicles and about 225 accessories exhibits.

The ninth automobile show occupied the week of Jan. 16-23, 1909. No less than 117 complete cars, 28 chassis, 37 electric vehicles and a number of commercial cars were shown.

The tenth national show held last year during the week of January 8-15 was the greatest ever held in America if not in the world.

How a Giant Company Grew

BY BENJAMIN BRISCOE, PRESIDENT UNITED STATES MOTOR COMPANY

The principal motive in the formation of the United States Motor Co. has been from its inception to secure that efficiency and economy that inevitably arises from a proper co-ordination of plants and facilities, from co-operation established between the personal and material elements of business.

The yearly capacity of the organization is: 18,500 Maxwells, 20,000 Brush runabouts, 1500 Columbias, 6000 Stoddard-Daytons, 2,500 Couriers; the original plant of the Alden Sampson Manufacturing Company at Pittsfield, Mass., together with the new Sampson plant nearing completion in Detroit, will produce 4,000 commercial motor vehicles; the Gray Motor Co., the Briscoe Manufacturing Co., and the Westchester Appliance Co. will manufacture marine motors, automobile parts and accessories valued at from $5,000,000 to $6,000,000.

The production is at all times well balanced and gauged to meet a well defined and carefully ascertained demand, and is free from any possible danger of over-production.

Many opportunities for co-operation and co-ordination of facilities have been taken advantage of; sales organizations and designing departments retain their independence with the idea of preserving to the fullest extent the individuality which existed formerly in the various products.

One of the missions of the company is to demonstrate to the American people that the automobile business is as reputably conducted and is as financially solid as any other business and, except in cases of occasional abuse, the automobile is as necessary and useful an implement of modern civilization as is the telephone and telegraph.

Stories of fabulous profits in this business, some of them to some extent true, has stimulated many ill-advised promotions, which are likely to have the result that is usual when any enterprise is attempted on insufficient capital or conducted by men unfamiliar with that business.

In a nutshell, the object of the United States Motor Car Co. is "to realize in the highest degree the efficiency and economy resulting from concentration and co-operation in production and distribution, whereby best value is given to the public in motor cars at such prices consistent with a fair and reasonable profit." The road to success along these lines can scarcely be regarded as difficult; there are ramifications, of course, but they are not difficult to cope with when encountered.

Continuing Interest in Sold Cars

BY HORACE DELISSER, VICE-PRESIDENT, UNITED STATES MOTOR COMPANY

Not infrequently does it happen that the prospective motorist places his order for an automobile without properly considering the standing of his dealer, or the extent to which the manufacturer has reached out to serve the user of his product after it is sold. However pleasing a car may seem during its early period of use or whatever satisfaction is expressed by the new owner, he should never lose sight of the fact that the permanence of the manufacturer's business, as well as the stability and facility of the dealer, is almost as necessary to ultimate satisfaction as fuel is to the operation of his car.

General appreciation of this fact is one of the safeguards of the motor industry. The manufacturer whose organization, principles or product fails to stamp him as an important and permanent fixture in the industry can scarcely do otherwise than leave a trail of regret among owners, and unsalable goods on the hands of dealers. Furthermore, the dealer finds that his local prestige has waned. Too often does it happen that the motorist's money is in the dealer's bank before the real importance of such analysis dawns upon him. Then the contrast between the flimsy and the strong becomes acute. Thousand of persons have learned the lesson and are now being educated to a realization of what it means to buy from responsible and aggressive firms that are well intrenched.

A strong firm selling cars on sheer merit in a thoroughly business-like way with an eye to the future recognizes that, however good a car may be or however expert the owner may become, a producing organization must keep in touch with the owner, either through dealer or through direct factory representatives, who are employed by some makers to insure satisfaction to the buyer. It also goes without saying that the men who undertake the supporting work must be capable, seasoned by experience, and willing, otherwise some of the favorable impression will be destroyed.

Shareholder in Rubber Company, who has had a narrow escape: "That's it, wear your d——d tires out."—From the Motor, in Australia.

Score of Meetings During Show Season

Nearly a score of important meetings of the major organizations of American motordom will be held during the A. L. A. M. show season. The societies which will hold annual conventions include the following: A. L. A. M., which will hold a number of sessions of executive committee and managers and its annual banquet; the N. A. A. M.; M. and A. M., meetings and annual banquet; A. A. A., various sessions of boards, etc.; S. A. E., annual convention and banquet; New York State Automobile Association; Manufacturers' Contest Association and the Automobile Credit Association.

It has been estimated that the attendance of the members of these organizations will be in the neighborhood of 3,000, which is said to be a conservative figure.

While the meetings of other years have attracted much attention, the schedule for this season is vastly larger and more important to the industry than ever before.

The list of stated gatherings announced up to the time of going to press is as follows:

Jan. 7.—Midwinter meeting of the New York State Automobile Association, Hotel Belmont, 10 a. m.

Jan. 10.—Meeting of the American Automobile Association Touring Information Board at National headquarters, 437 Fifth Avenue, 10 a. m.; meeting of the Executive Committee of the Association of Licensed Automobile Manufacturers at headquarters, 7 East Forty-second street, 10 a. m.

Jan. 11.—Annual meeting of the National Association of Automobile Manufacturers at 7 East Forty-second street; meeting of the American Automobile Association Legislative Board, 437 Fifth avenue, 10 a. m.; meeting of Society of Automobile Engineers at Automobile Club of America, 9 a. m.; dinner of the society of Automobile Engineers at the Automobile Club of America, 7 p. m.

Jan. 12.—Meeting of the Society of Automobile Engineers at Automobile Club of America, 2 p. m.; annual banquet of the Association of Licensed Automobile Manufacturers at Hotel Astor, 7 p. m.; meeting of Board of Directors of Motor and Accessory Manufacturers at 17 West Forty-second street, 10.30 a. m.; meeting of the Board of Managers of the Association of Licensed Automobile Manufacturers, 7 East Forty-second street; meeting of Cycle Parts Association, Hotel Astor, 8 p. m.; meeting of the American Automobile Association Good Roads Board, 437 Fifth Avenue, 2 p. m.; monthly meeting of the A. A. A. Executive Committee at the headquarters at 437 Fifth Avenue, 10 a. m.

Jan. 13.—Annual meeting and election of the Manufacturers' Contest Association at the headquarters of the Association of Licensed Automobile Manufacturers, 10 a. m.; meeting of the General Rules Committee of the Manufacturers' Contest Association at headquarters of A. L. A. M.; annual meeting of the Motor and Accessory Manufacturers' Association at Waldorf-Astoria, 6.30 p. m.; annual dinner of the Motor and Accessory Manufacturers' Association at Waldorf-Astoria, 7.30 p. m.

Jan. 18.—Annual banquet of the Automobile Trade Credit Association.

Excelsior Company Wins Appeal

CHICAGO, Jan. 4—The Court of Appeals for the Seventh Judicial Circuit handed down a decision in the appeal of the Excelsior Supply Company and the Motor Appliance Company versus Weed Chain Tire Grip Company. The Appellate Court reversed the decision of the lower court. The Excelsior company applied for the dissolution of the injunction, which was granted.

No Selden Decision So Far

Rumors persistently circulated early this week to the effect that a decision in the Selden case had been handed down proved to be groundless. Direct application to the Federal Court brought only a denial of any new order in the case.

To Break Show Record at Syracuse

SYRACUSE, N. Y., Jan. 2—At a meeting this week the show committee of the Syracuse Automobile Dealers' Association selected William R. Marshall, of this city, as manager for the 1911 show to be held at the State Armory in March.

Mr. Marshall, a former newspaper man here and now in charge of *The Spark Plug*, the official organ of the Automobile Club of Syracuse, acted as publicity manager for the exhibition last year, which W. D. Van Brunt managed. Previously Dai Lewis has been manager of the annual shows here.

The show committee is composed of Melvin W. Kerr, chairman; C. Arthur Benjamin, president of the association; George E. Messer, T. F. Willis, John H. Valentine and Edmund P. Horton.

It is stated that the coming show will contain many new features. The decorations are to be unique and the display of machines will be the largest ever seen here. Members of the show committee intend to attend the Madison Square Garden and Grand Central Palace shows in New York, also the Boston exhibition and that at Binghamton, to be held just prior to the event here. These trips are to be taken with the idea of getting pointers to improve the Syracuse show.

Work is being started earlier than ever before, the association feeling that in this way better success will be obtained, both from the standpoint of display and from the important one of fineness.

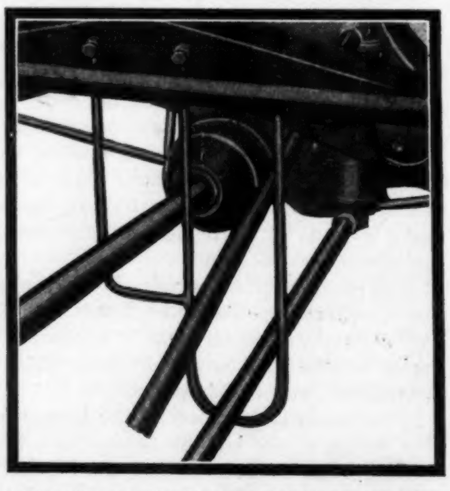
Monroe Company to Make Bodies

DETROIT, Jan. 2—Through the transfer of $162,000 in stock, R. F. Monroe, of Pontiac, has acquired the entire interests of the original stockholders in the Yeomans Box & Body Company, of Detroit. Some months ago the Monroe Body Company, of which Mr. Monroe is president, bought a controlling interest in the Detroit plant.

The company is capitalized at $500,000, of which stock amounting to $312,500 has been issued. It is the intention to greatly increase the capacity of the Detroit plant and put in a metal body business.

Measures for Safety That Are Taken

It is but rarely that anything happens to the propeller shaft and radius rods such as will cause either of them to detach from their fastenings and fall to the ground, but should such a thing happen, provided the car is in motion and going at a fast rate, it would be a serious occurrence. There is always the chance that something of this sort will transpire, and, recognizing the potency of the "ounce of prevention" plan, the E. R. Thomas Motor Company, of Buffalo, N. Y., has contrived the plan as shown in the accompanying illustration, in which a light but strong safety loop is so contrived that it passes around the suspended members and the extremities of the loop are bolted to the cross-bar of the chassis frame. The idea is a good one; it is executed in a neat and strong way, and, to the automobilist it is bound to appeal most forcibly.



Safety loop applied to Model M Thomas Flyer

Rules for Baltimore Display

Baltimore, Md., Jan. 2—The show committee of the Automobile Club of Maryland has announced the rules governing the show to be held from February 21 to 25, inclusive, in the Fifth Regiment Armory and will hold a meeting within the next week or so to name the date on which the dealers may draw for floor space. The rules are as follows:

First—Exhibitors who desire to show autos other than new ones must make application in writing to the committee, who will have the authority to grant such a request.

Second—Rulings of the show committee shall be final and dealers must agree to such without protest. The committee will have the power to remove at the cost of the dealers any autos, accessories or decorations contrary to the ruling of the committee.

Third—Space or any portion of it cannot be sublet by dealers without the consent in writing of the committee.

Fourth—Gasoline must be removed from autos or other articles before being taken into the armory.

Fifth—Exhibitors must protect floors, walls and woodwork from grease and oil and have drip pans under all cars.

Sixth—Precaution must be taken not to mar walls or woodwork.

Seventh—No screws or nails must be driven in floors, walls or woodwork.

Eighth—No decorations may be used without being approved by the committee.

Ninth—Exhibitors will indemnify and save the club and show committee from all damages to the armory, whether those specified or otherwise, which shall have resulted by reason of the installation, operation or removal of exhibits.

Alden Sampson Plans Outlined

The same officers as headed the Alden Sampson Manufacturing Company for the past year will remain in charge during 1911. They were named at elections held in New York. It was voted to add the title of assistant treasurer to the present officers.

The following were elected: President, Benjamin Briscoe; Vice-President, Morris Grabowsky; Treasurer, Frank Briscoe; Secretary, G. E. Mitchell; Assistant Treasurer, Fred C. Winckler.

S. B. Dusinberre, it was announced, will be placed in charge of the touring car division. Mr. Dusinberre is assistant general manager.

With the Detroit shops practically completed and the Pittsfield, Mass., factory tripled in capacity, the manufacturing area of the Sampson company will total 266,835 square feet. The Sampson company will build trucks ranging from the 1,000-pound light delivery motor to the five-ton size. The intermediate sizes are the one-ton, the two-ton, the three-ton and the four-ton.

Troy Club to Hold Show

Troy, N. Y., Jan. 2—The Automobile Club of Troy is to have an automobile show here in the State Armory under the auspices of the companies of the Second Regiment from January 30 to and including February 4. So far sixty different makes of cars have taken space and will be on exhibition, including both pleasure and commercial, as well as many exhibits of accessories, etc. The main floor is to be used only for complete automobiles. All accessories are to be in the basement.

Outlet for Pontiac Foundry

Detroit, Jan. 2—An arrangement was consummated last week by which the entire output of the Pontiac Foundry Company, of Pontiac, Mich., will be disposed of through Claire L. Barnes & Company, which sales company also handles the output of Billings & Spencer drop forgings and tools, and E. B. Wagner Manufacturing Company, die castings.

Colonnade at Milwaukee Show

Milwaukee, Jan. 2—An elaborate decorative scheme has been provided for the third annual Milwaukee show in the Auditorium from January 14 to 20 by the Milwaukee Automobile Dealers' Association. Ferry & Clas, one of the leading architectural concerns of the West, designed the plan, which will cost in the neighborhood of $5,000.

A colonnade of U-shape, extending nearly around the great arena of the Auditorium main hall, will be supplemented by a square colonnade on the stage, which will accommodate about six exhibitors. Unique designs have been provided for the smaller halls in the Auditorium as well as for the lobbies, all of which have been pressed into service for exhibition space. The show will open on Saturday night, January 14.

Austrian Government Guards Its Industries

The great principle of reciprocity is practically represented in its most pungent form in the process which obtains to a very great extent in Austria, quite a noticeable degree in Germany, and not a little in France. A member of the staff of The Automobile who now happens to be in Austria made application to visit some of the industrial establishments there, and the management of one of the large steel mills which is trying to break into the American market refused permission to see the works, giving as their reason the fact that they are bound by an agreement with the Austrian Government which does not permit them to let anyone inside of their plant, nor are they permitted to give out information for publication purposes.

Making Ready for Garden Apotheosis

Accompanying this article is an illustration made from an exclusive photograph taken in Madison Square Garden at 10 o'clock Tuesday morning. It shows more clearly than words the immense amount of labor required in whipping the big hall into shape for the opening of the A. L. A. M. show on Saturday evening.

An army of men is at work, including 260 carpenters, 100 steel men, 200 laborers, 25 painters, 25 electricians, 14 on the staff of Secretary Downs and 66 others.

Something over 110 miles of wire will be required for the system of telephones, while the company of guards will number 52 good and true men. There will be eight clerks from the post-office to handle the mail.

A feature of the show will be the Bureau of Information in which a force of men will be employed to facilitate traffic, give information about railroads, express, freight, 'phones and many other accommodations.

The telephone company stated that the Garden equipment of 'phones will be sufficient to handle about the same bulk of business as is handled in the city of Syracuse.

How the Garden looked four days before the opening

Personal Angles in A. M. C. M. E. A. Show

Major-General Fred D. Grant was the guest of honor at the opening of the Palace show. General Grant made an address and spent considerable time examining the aeronautical exhibits.

Clarence P. Hatter, assistant sales manager of the Velie Motor Vehicle Company, is in charge of the sales at the exhibit of that company at the Palace. Mr. Hatter's section is the center of attraction for visitors, who seem to be particularly interested in the beautiful roadster displayed by the Velie Company.

A. G. Carter, president of the Carter Motor Car Corporation, manufacturers of the Washington, is a skillful contest driver. In the late Munsey Historic Tour across four mountain ranges Mr. Carter piloted one of his cars to a perfect road score. His associate in the Washington section of the Palace show is W. D. Arrison, who duplicated Mr. Carter's feat in the big road run.

Benj. E. Neal, vice-president, is in charge of the Victor Motor Truck Company's exhibit of Victor trucks.

Monitor Truck exhibit—J. E. Noreling of Janesville is factory representative, while J. A. Flanagan of New York is representing the New York agency.

C. F. Case of Detroit is looking after the interests of the Oliver motor car.

Albert T. Otto, New York agent, is presiding over the Saurer truck exhibition.

L. E. Ewing, who moved from Geneva, Ohio, to Findlay to organize the Findlay Motor Co., has charge of the Findlay truck exhibit.

A. M. Chase, president and general manager of the Chase Motor Truck Co., and Sales Manager Durston are telling of the merits of Chase trucks.

F. Coleman of the F. Coleman Motor Co. of Ilion, N. Y., is showing the details of one of the newest trucks on the market, the Coleman wagon.

A. N. Spater, sales and advertising manager of Port Huron, has charge of the Cass Motor Truck Co. show.

Granville Hartman, general manager, and T. J. O'Neil, manager of the New York branch, are to be found at the Hart-Kraft exhibit.

Beyster-Detroit delivery cars are being shown by E. J. O'Hagan, sales manager of the company.

H. L. Moeller from New Haven is showing the New Haven Truck & Auto Works line.

W. J. Seitz from Detroit is showing Seitz trucks.

C. J. Gross of the Cross-Magill Motor Truck Co., New York, agents for the Gramm motor trucks, has charge of that exhibit.

W. P. Ferguson, special representative, and B. H. Zimmerman, assistant to the general manager, are telling all about the International Harvester Co. trucks.

T. A. Alcorn and L. E. Schlotterback are representing the Chicago Pneumatic Tool Co.

Walter H. Bentley, Sales & Adv. Mgr., is to be found at the American Standard truck exhibit of Detroit.

The Penn-Unit line of trucks is being explained by Paul J. Rippien of Allentown, Pa.

E. B. Olmstead represents the American Motor Truck Co.

The Geneva Wagon Co. is represented by R. M. Johnson, secretary and manager.

C. F. Johnson is in charge of the Commercial division of the Johnson Service Co.'s exhibition.

C. O. Meachem of Cortland, N. Y., is personally looking after the Cortland motor truck display

F. C. Lindoerfer, general sales manager of the Atterbury Motor Car Co. of Buffalo, is in charge of their display.

C. W. Kelsey is in charge of the Motorette, three-wheel car, of his own manufacture.

Richard B. Darre is exhibiting the three-wheel front wheel drive Cyklonette.

The Imperial exhibit is being looked after by T. A. Campbell, general manager, of Jackson, Mich.

E. C. Thompson of the Abbott-Detroit is recounting the showing of his line during the present season and telling of the improvements for 1911.

F. H. Lacy, general manager of the Jas. Cunningham Son & Co. Motor Vehicle Department, is in charge of the exhibit at the Grand Central Palace. With him are A. H. Whiting, E. C. J. McShane and G. U. Burdette of the recently organized Whiting Auto Co., New York agents for the Cunningham.

J. S. Grays of the Grays Motor Co. of Newark has charge of the Schacht exhibit.

Chas. La Due of the La Due-Cramer Co. of New York is exhibiting the Auburn line.

J. Mora Boyle and C. W. Shafter are looking after the interests of the Correja runabout.

C. E. Foster and H. M. MacFarlan of Connersville, Ind, are to be found at the MacFarlan Six exhibit

Paige-Detroit cars are being shown by H. Krohn of Detroit.

F. D. Garringer is explaining the merits of the Houpt-Rockwell cabs.

Major L. M. Fuller, general manager, C. F. Hatter, sales manager, and his assistants, P. R. Walker and C. R. Thompson, make up the selling force of the Velie exhibit.

W. H. Schwartz of Waltham, Mass., is telling of the merits of the Metz car.

W. L. Colt, of the Colt-Stratton Co., New York distributors of the Cole 30, has charge of that exhibit.

J. M. Quinby's interests are being looked after by H. T. Strong of Newark.

Fred Wright, assistant New York agent, is handling the Michigan proposition.

B. F. Blaney is looking after the pleasure vehicle interests of the Johnson Service Co.

A. H. Price has charge of the H. H. Babcock exhibit.

P. H. DeMange is the factory representative at the Henry exhibit.

E. W. Arborgst, general manager of the De Tamble Motors Co., is at the show from Anderson, Ind.

W. C. Leslie came on from the factory at Columbus to look after the Firestone-Columbus interests.

W. P. Mallon, the Eastern distributor, is showing both Krit and Paterson cars. Kenneth Crittenden is the factory representative of the Krit line, while both W. A. & W. S. Paterson are here from Flint in the interests of the Paterson car.

C. O. Schneider, the distributor, is explaining his new Arbenz car, manufactured in Chillicothe, Ohio.

E. H. Ervine is looking after the Otto line.

H. A. Briner of New York and Geo. Bailey from the factory at Milwaukee are to be found in the Petrel exhibit.

Sales Manager Geo. D. Wilson of Detroit has charge of the Warren-Detroit exhibit.

E. W. Hommel of Norwalk, treasurer of the Norwalk Co., and M. Wolf of the Clark Co. of Shelbyville are working together with A. M. Llano, the Brooklyn distributor of Clark and Norwalk cars.

E. E. Gregg of the Penn Motor Car Co. of Pittsburg is showing the Penn 30 pleasure cars.

The new Gaylord car is being shown by Mr. Gaylord himself.

Geo. D. Cranford, secretary, is on from the Cranford factory to look after his exhibit.

Chas. L. Jackson, president of the Eastern Sales Co., has charge of the Alpena Flyer. Willett E. Hazard is assisting at the Alpena Flyer exhibit in a demonstration of the Hazard motors which are used in the Alpena car.

J. M. Quinby & Company show the only imported pleasure car in the Palace show. It is an Isotta, 15-25, fitted with a quarter-glass brougham body. This company is also exhibiting three Pennsylvania models, a brougham, landaulet and touring car.

Kenneth Crittenden, of the Krit company, is an enthusiastic believer in his car. During the Munsey tour last Summer Mr. Crittenden drove one of his machines over the route and when an accident put him out of the running almost within sight of the finish he was inconsolable.